The Implementation of ERP System in Indian SMEs

Thesis

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The Implementation of ERP Systems in Indian SMEs

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Abstract

The objectives of the research reported in this thesis are to explore how enterprise resource planning (ERP) can be implemented successfully in Indian medium sized manufacturing firms and to understand why only some firms are able to implement ERP successfully, while others experience ERP failure.

A review of existing literature addressing ERP implementation in both large companies and SMEs was undertaken to identify specific gaps in the literature. The resource-based view (RBV) of the firm, absorptive capacity and the diffusion of innovations (DOI) were identified as insightful theoretical bases for the study.

A qualitative research methodology was adopted and, following a pilot study, data was collected through semi-structured, multi-respondent, in-depth interviews in nine case study firms. Data was analysed at three levels - within case, cross-case and group analysis.

The empirical findings indicate that firms undertaking a big bang ERP implementation through well-known international vendors are more likely to be successful than those firms adopting a step-by-step-approach with local vendors. A number of critical success factors (CSFs), consistent with existing studies of ERP implementation, were identified. This study demonstrates strong inter-linkages between the identified CSFs, with top management support playing a central and enabling role amongst the other CSFs. Furthermore, the study identified high absorptive capacity as another important CSF for ERP implementation.

The thesis offers a number of contributions. Firstly, it introduces the concept of absorptive capacity into a consideration of the CSFs of ERP implementation. It also provides a more in-depth understanding of the CSFs necessary for ERP implementation, how these are inter-related and demonstrates the central role of active top management involvement throughout the implementation process. Finally, it demonstrates the applicability of these concepts to medium-sized firms and to emerging economies such as India. The implications for practicing managers, limitations of the study and future research directions are also presented.

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CHAPTER 1: INTRODUCTION

1.1 Overview

The research presented in this thesis focuses on understanding enterprise resource planning (ERP) implementation in Indian medium sized firms. The main objective of this research is to explore 'how ERP system can be implemented successfully in Indian medium sized firms'. Section 1.2 describes the research rationale. The research scope and objectives investigated in the current study are presented in section 1.3. The structure of the thesis is outlined in section 1.4.

1.2 Research rationale

An ERP system has been considered arguably as the most well-known business software of the last fifteen years by many researchers and practitioners (Wagner *et al.*, 2006; Beheshti, 2006; Ehie and Madsen, 2005). ERP is defined as a packaged business software system that enables a company to manage the efficient and effective use of resources by providing a total integrated solution for the organisation's information processing needs, standardised across the enterprise (Nah *et al.*, 2001).

A review of ERP systems shows that a number of significant benefits can be realised in organisations where ERP systems are implemented successfully. Siau and Messersmith (2003) note that ERP systems have transformed the way companies are using information technology (IT) in their businesses. Shang and Seddon (2002) classified ERP benefits into the following groups:

1. Operational - these benefits relate to cost reduction, cycle time reduction, customer service improvement, productivity and quality improvement.
2. Managerial - relates to better resource management, improved decision making planning and performance management.

3. Strategic - benefits includes support for business growth, supporting business innovations, building cost leadership, generating product differentiation and building external linkages.
4. Organisational - these benefits relate to supporting organisational changes, facilitating business learning, empowering and building common visions.

Although companies spend millions on ERP packages and the implementation process, there is also extensive evidence that they experience considerable problems, particularly during the actual implementation process (Shehab *et al.*, 2004). One in four ERP projects are over budget and some 20 per cent are terminated before completion (Marnewick and Labuschagne, 2005). Most of the information available on ERP implementation success and failures is based on the studies of implementations in large firms (Muscatello *et al.*, 2003; Loh and Koh, 2004). All over the world, a number of SMEs have begun to recognise the significance of ERP. However, there is very limited research on ERP implementation in small and medium sized enterprises (SMEs).

Indian SMEs have consistently outperformed large industries on crucial parameters such as growth in production and growth in employment (Sharma and Bhagwat, 2006). In recent years, many ERP system developers and vendors have begun developing ERP software modules especially targeted at SMEs. For example, SAP, a market leader in ERP solutions has launched All-In-One package for 23 industrial practices for Asia-Pacific SMEs (SAP, 2006). The high failure rate in implementing ERP is a major concern because ERP systems require large investments in terms of capital, staff and management time (Adam and O'Doherty, 2000; Umble *et al.*, 2003). Most SMEs, especially the very small have limited financial resources, technological expertise and management skills (Blili and Raymond, 1993) compared to large enterprises. These constraints make it even more important for SMEs to implement ERP successfully as it would be difficult for them to overcome failed implementations compared to large enterprises (Muscatello *et al.*, 2003). Therefore,

research to identify and understand the factors that will lead to successful implementation and those factors that may inhibit such success in SMEs is required.

Finney and Corbett (2007) carried out extensive and comprehensive literature review to gain an understanding of the various critical success factors (CSFs) already identified by other researchers. According to these authors, most of the previous studies have focused on specific CSFs. They reported lack of research that covers all significant CSFs in a single study. Further, another observation by these authors is the lack of research that presented the major ERP implementation CSFs from the perspectives of key stakeholders. The authors identified that there is a need to focus future research on the in-depth study of CSFs from the perspectives of key stakeholders. Similarly, Martin and Huq (2007) report that both theory development and empirical studies are needed to continue the development of techniques and strategies for ensuring successful implementation of ERP projects.

Although studies have been conducted on ERP implementation cases in large organisations in the developed countries, limited empirical research is reported on the SMEs implementation experiences in Asia and other developing countries. Due to differences in the levels of IT adoption and use, cultural and social contexts, organisations in developing countries may face issues that are significantly different by firms in the developed countries. Specifically, there is lack of systematic empirical research studies which analyse the issues involved with ERP implementation in Indian firms (Tarafdar and Roy, 2003).

In summary, a literature review has revealed a gap in explaining issues concerned with ERP implementation in SMEs in developing countries. In particular, there is lack of research on such implementation in the specific context of Indian medium sized firms that are less constrained in terms of knowledge and resources. Given the importance of such firms to the Indian economy and, in turn, the importance of the Indian economy to the

global economy, this is a significant gap, which this study seeks to address. Therefore, the current study focuses on the detailed understanding of the factors from the firms' ERP stakeholders' perspectives that are likely to enable or inhibit ERP implementation success in Indian medium sized firms. Furthermore, this study provides theoretical explanations on 'why and how only some firms succeed in ERP implementation' informed by three theoretical perspectives, resource-based view (RBV), diffusion of innovation (DOI) and absorptive capacity. There is a lack of empirical research conducted so far, to the researcher's knowledge, which investigates ERP implementation success and failure in SMEs informed by theoretical perspectives. This is another significant gap that the current research addresses.

1.3 Research objectives

This research focuses on the following research objectives:

Research objective 1 - To explore how ERP can be implemented successfully in Indian medium sized firms.

Research objective 2 - Why only some firms are able to succeed in ERP implementation, while others experience implementation failure.

To address these objectives, the following specific research questions are investigated:

Research question 1 - How do ERP implementation strategies influence ERP implementation success in firms?

Research question 2 - How do the different factors that are critical to the successful implementation of ERP interact in order to achieve that success?

Research question 3 - How does the absorptive capacity of the firm influence the successful implementation of ERP?

1.4 Structure of the thesis

This thesis is composed of a total of nine chapters. In this first chapter, a research rationale and research objectives are presented briefly.

Chapter two discusses the context of research. It also defines important concepts related to the research subject.

Chapter three presents a literature review on SMEs characteristics, ERP definitions, advantages of successful implementation and implementation strategies. A wide range of empirical literature on the ERP implementation was reviewed to identify gaps in current knowledge. This chapter also presents a conceptual framework and reports ERP implementation CSFs that have been found in previous studies to influence implementation success.

Chapter four reviews the relevant theoretical perspectives - DOI, RBV and absorptive capacity, to provide theoretical bases for the research findings. The research questions are formulated in this chapter in order to address the identified research gaps.

Chapter five discusses the research paradigm and methodology, taking into consideration the nature of this research topic and the research questions. It presents in detail the selection of cases, the data collection process and the data analysis techniques.

Chapter six presents a summary of the nine case studies. This chapter presents a within case analysis of the ERP implementation process and how CSFs influence ERP implementation in each case.

Chapter seven presents the cross-case and group analysis of the nine case studies. The analysis explores the influence of CSFs, firms' internal resources and firms' absorptive capacity on the ERP implementation process.

Chapter eight discusses in detail the research findings, relating them to the specific research questions identified in chapter 4. The findings are compared with extant literature on ERP CSFs, RBV, DOI and absorptive capacity of the firms.

Chapter nine presents the conclusions, the contribution of the research to the existing body of knowledge and the limitations of the current study. This chapter also identifies opportunities for further research.

CHAPTER 2: RESEARCH CONTEXT

2.1 Introduction

Indian medium sized manufacturing firms are selected as a context to study the ERP implementation process. This chapter describes the rationale for this choice. Sections 2.2 and 2.3 discuss the definition of Indian SMEs and the features of Indian SMEs respectively. The importance of Indian SMEs and their contribution to the Indian economy is reviewed in section 2.4. E-business applications are discussed in section 2.5. ERP system implementation in the specific context of Indian SMEs is reported in section 2.6. The last section (2.7) summarises this chapter.

2.2 The definition of Indian SMEs

The definition of SMEs is country specific and generally includes more than one factor (for instance, number of employees, sales turnover, investment in assets, and so on). This is discussed further in section 3.2 in chapter 3. For the purpose of this study, the Government of India definition of SMEs based on capital investment in plant and machinery has been used. SMEs are those with an investment of not more than 50 million Indian Rupees (INR) and medium enterprises are those with an investment of over 50 million INR but less than 100 million INR in plant and machinery (Jain, 2006). At May 2008 average exchange rates, this is equivalent to an upper limit of around 625,000 Pounds Sterling (GBP) for small firms and a band of 625,000 GBP to 1,260,000 GBP for medium sized firms (Economist, 2008). The main focus of this study is on medium sized enterprises that have the resources to invest in adopting and implementing complex IT applications.

Indian SMEs have shown presence in nearly all sectors and manufacture approximately 7,500 different products. As shown in table 2.1, based on products, SMEs in India can be

classified in four major sectors - automobiles, electronics, machinery and processing (National Small Industries Corporation, 2002).

Table 2.1 - Products distribution in SMEs of various sectors

Industry sector	Item/product
Automobile	Automobile spare parts
	Repair services
Electronics	Small electrical items
	Semi conductor devices
Machinery	Electrical machinery and parts
	Wood products
	Transport equipment and parts
Processing	Food products
	Chemical and chemical products
	Basic metal industry
	Rubber and plastic products
	Hosiery and garments
	Non-metallic mineral products
	Paper products and printing
	Leather products
	Beverages, tobacco and tobacco products
	Cotton textiles
	Wool, silk and synthetic fiber textiles

Source - National Small Industries Corporation (2002)

In 2004, manufacturing sector accounted for 23 per cent of total GDP; the electricity, water supply and gas, mining, and construction sub-sectors accounted for 9 per cent; and service sector, comprising all other sub-sectors, accounted for the remaining 43 per cent. Therefore, if considered as a single group of activities, manufacturing is a major sector in the Indian economy (Kalirajan and Bhide, 2005).

In the manufacturing sector, Indian SMEs cater to both mass markets and local/regional markets, while others are part of a large production chains. For example, in the development of the Indian automobile industry. The large auto manufacturers, in order to maintain economic and efficient operations increasingly offload the manufacturing of parts

and components to SMEs. This sub contracting role is placing pressure on certain Indian SMEs to modernise and improve efficiency and productivity. The adoption of IT applications is often seen as a means to achieve these improvements.

2.3 Features - Indian SMEs

The report on 'e-commerce initiatives in India' (2003) states that the Indian SMEs sector has characteristics such as, operational flexibility, location mobility, low intensive imports, capacity to develop appropriate indigenous technology, access to technology-oriented industries and competitiveness in domestic and export markets. However, despite having advantages certain limitations have also been reported in Indian small-scale sector for example, low capital base, inadequate exposure to international environment, lack of professionalism and inadequate investment in research and development (R & D).

The industrial environment in India was traditionally characterised by its regulative and protective characteristics. The Indian economy was inward looking and protected from internal and external competition until 1990. Due to lack of competition, the technological capability needed for penetrating the global market was not developed in Indian firms. Since the abolition of the license system in 1991, Indian industry is facing competition from imports and from multinational companies (Dangayach and Deshmukh, 2006). Therefore, in recent years many Indian SMEs are focusing on the adoption and implementation of new technologies to remain competitive in a global economy.

2.4 Indian SMEs - contribution to Indian economy

The Indian economy was the world's tenth largest in 2004, with a nominal GDP of approximately $ 700 billion. Over the decade 1994-2004, the annual GDP growth for India has increased about 6.2 per cent (Wilson and Keim, 2006). SMEs have been recognised as a major contributor to the economy of both developing and advanced countries. India is no

exception and a significant increase in the contribution to economic development and employment by Indian SMEs has been observed in the past few years. Indian SMEs have consistently outperformed large industries on crucial parameters such as growth in production and growth in employment (Sharma and Bhagwat, 2006). Between 2001 and 2006, the small enterprise sector in India registered continuous growth in terms of units, production, employment and exports. During this period, the average annual growth in terms of employment was around 4.3 per cent and growth in the number of units was around 4.1 per cent (India budget, 2006).

2.5 E-business applications and SMEs

In recent years, Indian SMEs have shown an increased interest in the adoption of e-business applications as a means of becoming more efficient and competitive. However, as discussed in the next section, the level of adoption of e-business technologies among Indian SMEs varies significantly.

According to Lindgren (2001), e-business (EB) is e-commerce (EC) and business intelligence (BI), customer relationship management (CRM), supply chain management (SCM) and ERP.

A similar kind of definition has been provided by Koh and Maguire (2004). They described an 'e-business suite' as a total solution approach, and usually consist of SCM, ERP and CRM to help enterprises to increase their operating efficiency.

The terms used in the above definition can be described as:

Business intelligence - the process of gathering information about customer needs, customer decision-making processes, competition in the industry, technological and economic trends.

Customer relationship management - includes all aspects of interaction a company has with customers. It enables organisations to serve its customers through the introduction of reliable processes and procedures for interacting with customers.

Supply change management - the process to produce and deliver a final product or service, from the procurement of raw materials to the distribution of finished products to customers.

Enterprise resource planning - consists of applications to integrate and streamline the business operations of the firm.

According to Department of Trade and Industry (2001), e-business describes a high degree of integration of communication technologies with business processes and management practices. Usually e-business involves the use of the web (Internet, intranet and extranet) to conduct business including buying and selling, connects key players to critical business systems and allows access to the information they need.

As e-commerce is an important part of e-business, it is important to understand what e-commerce means. According to Organisation for Economic Co-operation and Development (OECD, 1998), e-commerce can be defined as business occurring over networks using the Transmission Control Protocol/Internet Protocol (TCP/IP), that is, the Internet, intranets and extranets. It therefore refers to the use of Internet technologies for internal business processes (intranet), for business relationships (extranet), and for the buying and selling of goods and information exchange (Internet).

Among all the e-business applications, the adoption of ERP systems is beginning to grow in Indian SMEs. The last few years have seen growth of ERP providers exploring the opportunities in the Indian SME segment to streamline and integrate business operations (Tarafdar and Roy, 2003).

ERP systems generally comprise a suite of software modules that lets an organisation automate and integrate the majority of its business processes (Davenport, 1998) by sharing common data and practices across the enterprise to produce and access information in a real-time environment (Marnewick and Labuschagne, 2005).

2.6 ERP implementation in firms

Indian SMEs are expected to account for a 47 per cent share of the overall ERP market in India over the next five years according to International Data Corporation, a market research and analysis firm specialising in IT, telecommunications and consumer technology (Munjal, 2006). Though Indian firms are implementing ERP systems in their firms, most of them have not witnessed expected results (Venkatesh, 2003) because ERP implementation is a complex process that involves large investments in terms of resources (Rajshekhar, 2000) and often, significant re-organisation of the firm.

Although companies spend millions on ERP packages and the implementation process, there is extensive evidence that they experience considerable problems, particularly during the actual implementation process (Shehab *et al.*, 2004). The high failure rate in implementing ERP is a major concern. One out of four ERP projects is over budget and some 20 per cent are terminated before completion (Marnewick and Labuschagne, 2005).

2.7 Summary

A significant increase in the contribution of economic development and employment generation by Indian SMEs has been observed in the past few years. Thus it is important to study medium sized firms and how their businesses can be made more efficient. ERP is one of the technologies, if implemented successfully, that can assist medium sized firms to improve their organisational performance since it can automate an entire business. However, ERP implementation is a challenging process. The purpose of this study is to

understand the ERP implementation process and how it can be undertaken successfully in Indian medium sized manufacturing firms.

CHAPTER 3: LITERATURE REVIEW

3.1 Introduction

This chapter presents an overview of the existing literature that relates to the adoption and implementation of ERP in SMEs. The key purpose of the comprehensive literature review is to identify key issues of theory and practice in the implementation of ERP technology by medium sized firms and to formulate the research questions by identifying the research gaps in the area of ERP systems implementation. An important part of this process is also to review research methodologies that have been adopted in the past to study ERP implementation and to examine those related aspects that enhance knowledge of the ERP systems implementation process.

In spite of frequent references to SMEs in the literature, there is no generally accepted definition of SMEs, with different definitions prevailing in the EU, the US and India. In section 3.2, SMEs are defined and their characteristics are discussed. In section 3.3, ERP evolution and definitions are discussed. The importance of ERP and the reasons of ERP adoption by SMEs are described in sections 3.4 and 3.5 respectively. ERP implementation processes and models in earlier studies are considered in more detail in section 3.6. ERP literature and studies tend to have a relative definition of what constitutes successful implementation and this is discussed in section 3.7. CSFs to be taken into the consideration during ERP implementation are also discussed in this section. The conceptual framework that guides the research process is presented in section 3.8. The last section, 3.9, summarises the main points in this chapter.

3.2 SMEs - Definitions and characteristics

Sub-section 3.2.1 presents definitions of SMEs and is followed by a discussion of SMEs characteristics in sub-section 3.2.2.

3.2.1 Definitions of SMEs

The definition of SMEs generally depends on one or more factors (for instance, number of employees, sales turnover, investment in assets and so on) and it is country specific. According to a World Bank study, there are said to be more than 60 definitions of small and medium industries used in 75 countries surveyed (Ministry of small-scale industries, 2004). Some define them in terms of assets (for example, India), a few in terms of sales and some in terms of employment (for instance, UK). Further, countries which adopt employment as a definition, can also differ in their definitions according to the industry where the firm operates.

As discussed in chapter 2 (section 2.2), for the purpose of this study, the Government of India definition of medium sized firms based on capital investment in plant and machinery has been used (table 3.1). According to this, medium enterprises are those with an investment of over 50 million INR (GBP 625,000) but less than 100 million INR (GBP 1,260,000) in plant and machinery (Jain, 2006).

Table 3.1 - Definitions of SMEs

Country	Category	Criteria
USA	Small	20-99 employees
	Medium	100-499 employees
UK	Small	10-49 employees
	Medium	50-249 employees
India	Small	Up to 50 million INR initial capital investment
	Medium	50 million INR-100 million INR initial capital investment

Source - Adapted from Dangayach and Deshmukh (2006)

3.2.2 SME characteristics

Distinguishing characteristics of SMEs can be limited resources in terms of personnel, finance and knowledge pertaining to management, marketing, commercialisation or IT (Jutla *et al.*, 2002). Despite having limited resources, SMEs can possess many counter balancing advantages. Compared to larger organisations with established hierarchies, SMEs are usually more entrepreneurial, willing to experiment and innovate (Caskey *et al.*, 2001) in terms of business models and operations (Jutla *et al.*, 2002). Further, many SMEs have proven their importance in the increased global competition by utilising their advantages, such as being more flexible and lower overheads than larger enterprises (Blili and Raymond, 1993).

Due to the lack of resources and their fragility in the formative stage, small businesses often face difficulties. Many SMEs are unable to take advantage of the new concepts in information and communication technology (ICT) because of the lack of relevant knowledge, lack of necessary investment (Koh and Maguire, 2004), technical and Internet marketing skills required in the area of e-business and knowledge management.

Moreover, many SMEs lack appropriate guidance to allow them to take advantage of the developing knowledge economy and move towards the e-business era (Koh and Maguire, 2004) as compared to larger organisations that have a greater capability to make use of e-business and knowledge management due to their access to the required skills and resources. However, many Indian SMEs are now focusing on the management of information system (IS) practices in their day-to-day operations (Sharma and Bhagwat, 2006) and adoption of new technologies to remain competitive in a global economy.

One such technology that is attracting attention from Indian SMEs is ERP systems. One of the prime reasons for Indian SMEs to deploy ERP is to integrate and streamline their business processes. According to International Data Corporation (2006), over the next five

years the ERP market in India is expected to reach $ 341 million. Of this, 47 per cent of total market is expected to be accounted for by SMEs. This means SME potential in India is projected to be $160 million. This clearly indicates SMEs in India have begun to realise the necessity of installing ERP systems.

3.3 The evolution and definition of ERP

In sub-section 3.3.1, the evolution of ERP is described. The various definitions of ERP available in the literature are then discussed in sub-section 3.3.2. The definition of ERP to be used in the present research is also provided in this section.

3.3.1 Brief history of ERP

The history of ERP can be traced back to 1960s when the focus was mainly on inventory control in manufacturing organisations. In the late 1960s materials requirement planning (MRP) was started through a joint effort between J. I. Case, a manufacturer of tractors and other construction machinery, and IBM. Early MRP application software was the state-of-the-art method for planning and scheduling materials for complex manufactured products. Initial MRP systems were large and expensive, as they required a large technical staff to support the mainframe computers. To overcome these difficulties, new software companies that would later become key ERP vendors were initiated in the 1970s. For example, 'SAP' (Systems, Applications and Products in data processing) was started by five engineers in Mannheim, Germany to produce and market standard software for integrated business solutions; 'J. D. Edwards' and 'Oracle Corporation' were established in 1977 and in 1978 Jan Baan began 'The Baan Corporation' in the Netherlands to provide financial and administrative consulting services (Jacobs and Weston Jr., 2007).

In the early 1980s, J. D. Edwards developed software, which was a much lower cost alternative to the mainframe computers. It offered flexible disk drives with capacities

useful for small and medium size businesses. The term manufacturing resource planning II (MRP II) was coined at this time to identify the newer systems capabilities. MRP II included a set of modules for each of the different functional aspects of the production process (table 3.2).

Table 3.2 - Historical evolution of ERP systems

Types of systems	Time	Purpose
Materials requirement planning (MRP) system	Late 1960s	To plan manufacturing of products and ordering inventory
Manufacturing resource planning (MRP II) system	Early 1980s	To schedule and monitor the execution of production plans
ERP system	Early 1990s	To integrate firm's business processes to create a seamless information flow

Source - Basoglu *et al.*, (2007)

The Gartner group of Stanford, USA coined the term ERP in the early 1990s to describe the business software systems that were the latest enhancement of MRP II systems (Chen, 2001). ERP may be considered as the next generation of MRP II systems because it brings together the functionality of MRP II with other application areas (quality, maintenance, marketing, accounting etc.). According to Ptak and Schragenheim (2000), rather than being just MRPII with a new name, ERP is the next logical level in an evolutionary series of computer tools for operations. ERP is not limited to manufacturing companies, but is useful for any company that has a need to integrate their information across functional areas (Abdinnour-Helm *et al.*, 2003).

3.3.2 Definition of ERP system

Various definitions of ERP systems are available in the literature over the last decade. ERP systems generally comprise a suite of software modules that allows an organisation to automate and integrate the majority of its business functions (Davenport, 1998) by sharing

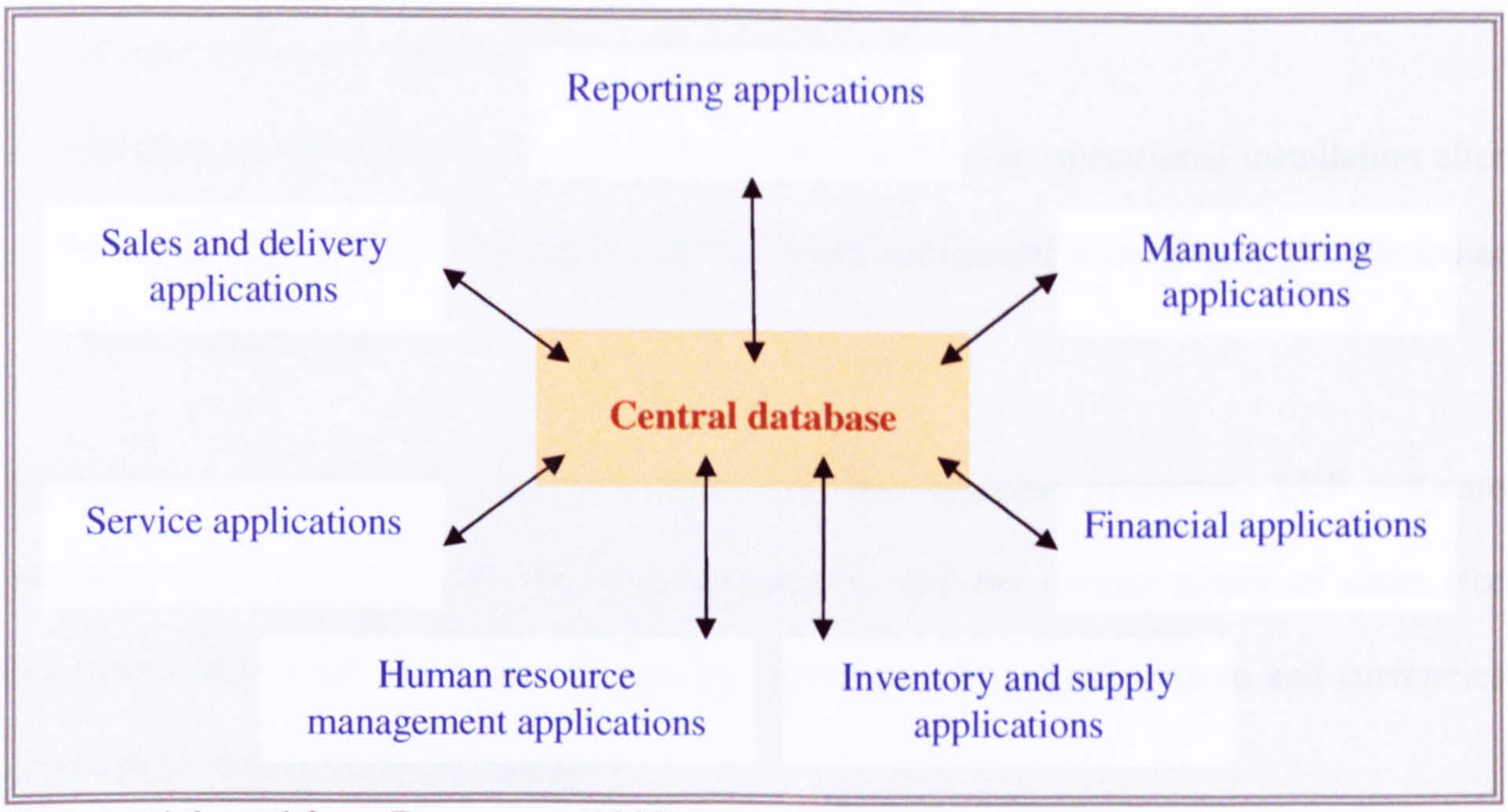
common data and practices across the enterprise to produce and access information in a real-time environment (Marnewick and Labuschagne, 2005).

At the strategic level, the ERP system can be defined as a packaged software system that enables a company to manage the efficient and effective use of resources (materials, human resources, finance etc.) by providing a total and integrated solution for its information processing needs (Davenport, 1998; Nah *et al.*, 2003).

At the operational level, Gable (1998) defines ERP as a 'comprehensive package software solution that seeks to integrate the complete range of business processes and functions in order to present a holistic view of the business from single information and IT architecture'. Watson and Schneider (1999) also provided similar definition, but in their definition they further elaborated the functional areas involved. They defined ERP as an integrated and packaged software-based system that handles the majority of an enterprise's system requirements across all functional areas such as finance, human resources, manufacturing, sales and marketing.

The ERP system modules usually are financial and cost accounting, sales and distribution, materials management, human resources and production planning. These tools allow the centralised recording of many business activities in a single database such as production, inventory management, sales, delivery and billing (figure 3.1). Hence, the need for multiple entries of the same data can be eliminated (Muscatello *et al.*, 2003).

Figure 3.1 - Integration of applications through ERP systems



Source - Adapted from Davenport (1998)

The Eleventh Edition of the APICS (American Production Inventory Control Society) Dictionary (Blackstone and Cox, 2005; 38) defines ERP as a 'framework for organising, defining and standardising the business processes necessary to effectively plan and control an organisation so the organisation can use its internal knowledge to seek external advantage'. This definition highlights the broad scope of applications that fit under the ERP framework.

ERP systems are described as integrated (Zhang and Li, 2006; Olhager and Selldin, 2003) because the applications share a common database (Boykin, 2001) and transaction data can flow seamlessly from one 'module' to the next, without re-keying or software interfaces (Davenport, 1998). In other words, as described by Mabert *et al.*, (2003), ERP systems are enterprise-wide on-line interactive systems that support cross-functional processes using a common database.

Klaus *et al.*, (2000) have identified the following three different forms of ERP software:

1. Generic - this software needs to be configured before it can be used.

2. Pre-configured - in this software, pre-configured templates are tailored to suit specific industry sectors or companies of a certain size.
3. Installed - in this form, ERP software presents itself as the operational installation after the generic or pre-configured package has been configured according to the particular firm's requirements.

Enterprises can select any one form based on their business processes. ERP software available from ERP vendors can be configured to suit the diverse needs of users (for example, country specific chart of accounts, invoices, HR payroll system and currencies across most sectors of the economy).

In conclusion, ERP systems integrate, automate and manage firm's business processes. In the present study, an ERP system would mean those applications that can be used for integration of business processes across the enterprise in different locations.

3.4 Significance of ERP systems

A review of ERP literature shows that significant gains can be observed if ERP systems are implemented successfully. Siau and Messersmith (2003) point out ERP systems have revolutionised the way companies are using IT in their businesses. ERP is meant to replace the old systems, usually referred to as 'legacy systems', that provide support for specific functional areas. A major growth of ERP software and systems during the last few years was due to the year 2000 (or Y2K) problem. Many SMEs adopted the new ERP technology because their legacy system software was not Y2K compliant (Jacobs and Weston Jr., 2007).

Enterprise system packages are designed to address the problem of fragmentation of information or 'islands of information' in business organisations by automating an entire business with a suite of software modules covering activities in all areas of business

(Muscatello *et al.*, 2003). It presents a holistic view of the business from single information and IT architecture (Klaus *et al.*, 2000). Prior to these packages, firms were constantly faced with difficulties in aligning technology to their business needs (Loonam and McDonagh, 2005). Similar to these views, according to Nah *et al.*, (2001), ERP systems can automate and integrate business processes across organisational functions and locations and share common data and practices across the entire enterprise in order to reduce errors and access information in real time. This access should facilitate rapid and better decisions and result in cost reductions.

According to Siriginidi (2000), the primary objectives in implementing ERP are business process re-engineering (BPR - analysis and redesign one or more of a company's business processes), improvement in quality of information, replacement of out of date procedures and systems, integration of business processes and reduction in stand-alone systems.

In terms of strategic importance to the companies that implement ERP, Scott and Vessey (2000) consider the significance from a business and technical perspective. From a business perspective, for example, ERP systems can facilitate re-engineering business processes, global operations, competitive agility and data integration across the enterprise. From a technical perspective, they can facilitate the installation of more flexible and scaleable architectures. Palaniswamy and Tyler (2000) also emphasised that the process of ERP implementation forces organisations to increase their understanding of core capabilities and make necessary changes to business processes that may otherwise have been ignored.

Shang and Seddon (2002) classified ERP benefits into the following five groups:

1. Operational - these benefits relate to cost reduction, cycle time reduction, customer service improvement, productivity and quality improvement.

2. Managerial - relates to better resource management, improved decision making planning and performance management.
3. Strategic - benefits includes support for business growth, supporting business innovations, building cost leadership, generating product differentiation and building external linkages.
4. IT infrastructure - benefits involve building business flexibility, IT cost reduction and increased IT infrastructure flexibility.
5. Organisational - these benefits relate to supporting organisational changes, facilitating business learning, empowering and building common visions.

To summarise, ERP systems can provide significant benefits by integrating and automating business processes across the organisation. These benefits can be observed at both an operational and strategic level. However, it is necessary to implement ERP successfully in order to gain the full benefits available. The issues involved in successful ERP implementation are discussed in section 3.7. The reasons for ERP adoption by SMEs and the kind of benefits they can derive from these systems are explained in the next section.

3.5 ERP implementation by SMEs

In recent years, most ERP system suppliers have increased their focus on SMEs, due to which, increasingly SMEs are finding it cost effective and a competitive necessity to adopt ERP (Klaus *et al.*, 2000). It is claimed that SMEs can benefit both technically and strategically from investments in enterprise systems (Markus and Tanis, 2000). Moreover, competitive capabilities (Smith, 1999) can be enhanced by installing ERP packages. Markus and Tanis (2000) have identified the technical and business reasons which can motivate SMEs to adopt ERP systems. The technical reasons include the integration of applications, improved cross-functional working, reduced software maintenance, elimination of multiple data entry, improved IT architecture, decreased computer operating

costs and the replacement of hard to maintain interfaces. Business reasons leading SMEs to adopt ERP include business growth, improvement of business processes, reduction of inventory costs and elimination of errors in filling customers' orders.

3.6 ERP implementation models and strategies

It is necessary to gain knowledge of various implementation models and processes suggested by previous literature to understand how these models can help in successful implementation of ERP in organisations. The concept of process models and factor models are discussed in sub-section 3.6.1. Sub-section 3.6.2 gives details on ERP models and the various phases of the implementation process found in the existing academic literature. Implementation strategies also play an essential role in making ERP successful in organisations. These strategies are discussed in sub-section 3.6.3.

3.6.1 Process and factor models

Newman and Robey (1992) in their paper discuss process models and factor models in research on information system development. The factor approach identifies the potential predictor (or independent) variables and associates them with a level of successful system development (outcome). Factor research models consider predictors as factors that vary in degree or intensity. This research model is based on the assumption that variation in these predictor variables accounts for variation in outcome (or dependent) variables. However, factor (or variance) approach does not explain how outcomes occur (Hinton, 1994).

In comparison, process models explain the degree of association between predictors and outcomes (Newman and Robey, 1992). Process research describes the sequence of events that occur over time in information system development to explain how and why particular outcomes are reached (Robey and Newman, 1996; Mohr, 1982).

"The difference between the variance and process approaches is that variance models search for factors that are seen as necessary and sufficient conditions for an outcome to occur. By contrast, process models aim to identify conditions that are seen as necessary but insufficient to cause an outcome" (Hinton, 2002; 329).

Newman and Robey (1992) in their work further explain factor and process models can be complementary approaches to research. "Factor research establishes strong empirical connections between antecedent conditions and later outcomes, while process research should examine the stream of activities that explain these connections" (Newman and Robey, 1992; 251). This is the approach taken in this thesis where both the critical success factors and the processes involved in ERP implementation were taken into account.

3.6.2 ERP implementation models

The ERP systems experience model developed by Markus and Tanis (2000) focuses on the sequence of events involved in ERP implementation (table 3.3). The authors recognise the following four distinct phases:

1. Chartering - the authors suggested that this is the very first phase of any enterprise system implementation. This phase comprises of activities that can help companies to decide whether they should implement ERP. The key players in this phase are vendors, consultants, company executives and IT specialists.
2. Project phase - this phase comprises mainly of system configuration and rollout. Key players are Project Manager, project team members, internal IT specialists, vendors and consultants.
3. Shakedown phase - refers to the period from 'going live' until 'normal operation' has been achieved.
4. Onward and upward phase - this phase covers normal operation until the system is replaced with an upgrade.

Table 3.3 - Activities in ERP implementation phases

Phases	Activities
Chartering phase	a. Initiation of idea to adopt ERP b. Developing business case c. Initiation of search for project leader, selection of software and implementation partner d. Project planning and scheduling
Project phase	a. Software configuration b. System integration c. Testing d. Training e. Roll out
Shakedown phase	a. Bug fixing and rework b. System performance and tuning c. Retraining d. Staffing up to handle temporary inefficiencies
Onward and upward phase	a. Continuous business improvement b. Building additional user skill c. Upgrading to new software releases d. Post-implementation benefit analysis

Source - Adapted from Markus and Tanis (2000)

Parr and Shanks (2000) have suggested a project phase model (PPM) for ERP implementation. Although very similar to Markus and Tanis (2000) model, this model does not include the shakedown phase. The authors identify three major phases:

1. Project planning - this is similar to chartering phase as described by Markus and Tanis.
2. Project phase - this phase divides into five sub-phases: set-up, re-engineering, design, configuration, testing and installation.
3. Enhancement phase - this includes the activities of the onward and upward phase of Markus and Tanis (2000).

A more elaborate set of steps for ERP implementation has been proposed by Callaway (1999). The author suggests that an enterprise system project would comprise of the project preparation phase, planning of the business processes, configuring the system according to

the planned business processes, testing and validating the configured system, final preparation of the system and finally going live with the system. Although this model provides all the necessary steps for implementation, it does not propose the early initial chartering phase that is suggested by Markus and Tanis (2000).

In an attempt to provide a conceptual ERP model that gives holistic view of ERP, Marnewick and Labuschagne (2005) have described the following five steps that make up an ERP implementation methodology:

1. Pre-implementation phase - the operational needs, business drivers, strategic plans and other factors that will define the scope and objectives of the ERP solution are identified and agreed.
2. Analysis phase - the organisational baselines that form the foundation for process redesign, the system build and change management are evaluated.
3. Design phase - direction-setting information from the pre-implementation phase is used to create new designs for a desired future state.
4. Construction phase - products from the design process are used to create tangible operational processes.
5. Implementation phase - this phase consists of final ERP deployment. Final changes are made to the business processes, policies, procedures and system builds to prepare for a go live.

The limitation of this methodology is that it does not attempt to provide a detailed, step-by-step approach for implementing an ERP system and is based on a conceptual framework. A view of the ERP implementation process that was derived from discussions with 20 practitioners and from studies of three multinational corporation implementation projects has been presented by Bancroft *et al.*, (1998). This model has the following five phases:

1. Focus phase - this is essentially a planning phase in which the key activities are the set-up of the steering committee, selection and structuring of the project team, development of the project's guiding principles and creation of a project plan.
2. As is phase - involves analysis of current business processes, mapping of the business processes on to the ERP functions and training of the project team.
3. To be phase - this phase involves detailed design subject to user acceptance.
4. Construction and testing phase - involves the development of a comprehensive configuration, the population of the test instance with real data, building and testing interfaces, writing and testing reports and finally, system and user testing.
5. Implementation phase - covers building networks, installing desktops and managing user training and support.

Whilst this model does contain relatively detailed descriptions of activities at each stage, like the model by Parr and Shanks (2000), it fails to include consideration of the activities after going live such as the 'shakedown' and 'onward and upward' phases of Markus and Tanis (2000).

Table 3.4 provides summary of ERP models and shows the differences in terms of the phases identified in each of these models.

Table 3.4 - ERP implementation models in existing ERP literature

ERP process models	ERP implementation phases
Bancroft *et al.*, (1998)	a. Focus b. As is phase c. To be phase d. Construction and testing e. Implementation
Callaway (1999)	a. Project preparation b. Planning of business processes c. Configuration of system d. Final preparation e. Going live with system
Parr and Shanks (2000)	a. Planning b. Project c. Enhancement
Markus and Tanis (2000)	a. Chartering b. Project c. Shakedown d. Onward and upward
Marnewick and Labuschagne (2005)	a. Pre-implementation b. Analysis c. Design phase d. Construction phase e. Implementation phase

Source - Compiled by the author

Although all the implementation models mentioned in this sub-section present a view of the implementation process, differences in terms of implementation phases are apparent (for example, in the Markus and Tanis model, the chartering phase begins before Bancroft *et al.*,'s focus phase). The details of how these phases have been generated and developed are lacking in most of these studies. Further, except in the Markus and Tanis model (2000), a lack of detailed activities in each of the proposed stages is given. In the current study, activities of implementation process are informed by the Markus and Tanis's (2000) model.

3.6.3 ERP implementation strategy

ERP is not only a software system that needs to be configured, it also imposes its own logic on a company's strategy, organisation and culture (Davenport, 1998; Lee and Lee, 2000). There are two different strategic approaches to ERP implementation. In the first approach, an organisation re-engineers their business processes to match the functionality of the ERP system. This means making changes in ways of doing existing business operations, changes in people's roles and responsibilities. The other approach is customisation of the software to fit the existing processes. This approach sometimes can delay the project and might introduce errors in the system. Furthermore, upgrading the software to the ERP vendor's next version can then also become difficult in the future (Koch *et al.*, 1999). Therefore, ERP implementation involves the critical choice of changing business processes or modifying the software (Boykin, 2001; Clemmons and Simon, 2001). To implement ERP systems, companies often seek the help of an ERP vendor or of third party consulting companies.

The implementation strategy defines how the implementation should be realised. Sankar and Rau (2006) describe the following ERP implementation strategies:

1. Step-by-step implementation - in this implementation strategy, usually a single module is implemented at a time. This strategy is good for smaller organisations as costs are spread over time, complexity of implementation is reduced and with every step project teams gain knowledge which they can use in the subsequent implementations. However, in this strategy, many interfaces have to be built so that the new and existing modules can communicate with each other. The creation of interfaces can be a difficult job that requires technical ERP implementation knowledge and skills.

2. Big bang implementation - this is a complex implementation process as existing systems are replaced in a single operation. This strategy should include an intensive testing phase to check business processes in detail and a very capable project team.
3. The rollout implementation - this strategy creates a model implementation for one area of the company and then rolls it out to other areas. This involves less risk as most of the problems are already solved in the model implementation. This strategy is generally used in multinational companies. A model implementation often starts in the company's home country and once completed, it is implemented in other areas.

Zhang and Li (2006) have also suggested similar kind of implementation strategies. However, the authors have given different name to the techniques. They classified the implementation techniques as - complete conversion, progressive conversion, special type progressive conversion and parallel conversion. In the complete conversion method, all the modules of the ERP system are implemented at once. In progressive conversion method, sub-systems or modules are implemented one at a time, while in the special type progressive conversion method, a temporary linkage between the new system and the existing system is formed. In the parallel conversion method, the new and existing systems may be operated at the same time for a certain period.

Though the terms step-by-step, big bang and roll out have been widely used in the literature, the research on how these strategies impact ERP implementation success is very limited. This is evident in the next section that discusses the CSFs of ERP implementation.

3.7 ERP implementation success factors

This section commences with a sub-section 3.7.1 on the concept of ERP implementation success. The concept of CSFs and the reasons for understanding the CSFs in ERP implementation process is introduced in sub-section 3.7.2. Sub-sections 3.7.2.1 and 3.7.2.2

review current academic literature on ERP implementation CSFs for large enterprises and SMEs respectively.

3.7.1 ERP implementation success indicators

According to the IS implementation literature, a system can be considered a success if it is perceived to be satisfactory and willingly used by key stakeholders. User satisfaction is the most widely used single measure of success in IS research and has a high degree of face validity (Delone and McLean, 1992) and it is especially appropriate when a specific IS is involved (Hamilton and Chervany, 1981).

Limited research is available on the concept of ERP implementation success. Bhatti (2006) measured ERP implementation success by using the following four criteria:

1. The ERP system implementation was completed within the time schedule.
2. The ERP system implementation was completed within budget.
3. Users were satisfied with the ERP system.
4. Users find it easy to access information through the ERP system.

Umble *et al.*, (2003) have considered ERP implementation success in terms of ERP benefits achieved. These benefits can be personnel reductions, a decrease in the cost of IT, better inventory control and an improvement in order and cash management.

Consistent with existing studies, in this study a successful ERP implementation is taken as an ERP system that has been completed within the scheduled time, within the estimated budget (Bhatti, 2006; Garcia-Sanchez and Perez-Bernal, 2007) and delivers user satisfaction (Bhatti, 2006) and ERP benefits (Umble *et al.*, 2003).

3.7.2 Critical success factors in ERP implementation

There is extensive evidence that companies experience considerable problems during ERP implementation process, though they spend millions on ERP packages and the implementation process (Shehab *et al.*, 2004). The high failure rate in implementing ERP is a major concern. One in four ERP projects is over budget and some 20 per cent are terminated before completion (Marnewick and Labuschagne, 2005). For example, Fox Meyer Drug argues its ERP system led it to bankruptcy; Dell computer realised its system would not fit its new decentralised management model. Similarly, Applied Materials gave up on its ERP system when it realised the significant organisational changes involved; Waste Management Incorporated aborted its SAP implementation after it had spent $45 million of the estimated $250 million needed (Abdinnour-Helm *et al.*, 2003).

Enterprises that succeed in completing ERP system implementation on schedule and do not exceed the original budget account for only 10-20 per cent of firms. About 30-40 per cent of enterprises fail to realise system implementation completely and about 50 per cent are not successful in implementation (Zhang and Li, 2006).

These kinds of unsuccessful implementations are not only due to technical challenges but also due to other issues. The type of issues that arise during implementation of ERP range from specific issues that can come up during the installation of an ERP, to behavioral, procedural, political and organisational changes, that can emerge subsequent to the installation (Verville *et al.*, 2005). The implementation of an ERP project requires the organisation to pay attention to a variety of stakeholders (for example, management, IS professionals, users, consultants and trading partners) (Grabski and Leech, 2007).

The CSFs and process models proposed in the existing academic ERP literature to overcome the difficulties of ERP implementation are discussed in the following paragraphs. According to Bullen (1995), the concept of CSFs was introduced in 1979. The

CSFs approach is used by organisations and managers as a framework for strategic planning. It directs the organisation in determining those things that must go right and helps management to focus attention on the tasks and activities that need to be performed well to achieve success (Bullen, 1995). In the context of ERP implementation, the CSFs can be defined as the critical points where attention needs to be paid during the process of implementation. Understanding and managing these key points can lead to a successful ERP implementation (Zhang and Li, 2006). The review on CSFs for successful implementation in large sized and small medium organisations is discussed in the following sub-sections.

3.7.2.1 CSFs in large enterprises

Nah *et al.*, (2001) stress the importance of CSFs in all phases of the implementation of ERP systems. Through a review of literature undertaken by the authors, 11 factors were found to be critical to ERP implementation success. The authors adopted the ERP systems experience model (Markus and Tanis, 2000) to classify these 11 CSFs:

1. Chartering phase - CSFs in this phase are ERP composition, top management support, business plan and vision, effective communication, project planning, project champion, appropriate business and IT legacy system.
2. Project phase - change management program, BPR, minimum customisation, software development and testing and trouble shooting.
3. Shakedown phase - performance evaluation and monitoring.
4. Onward and upward phase - business plan and vision.

Nah *et al.*, (2003) identified similar CSFs in their study of ERP implementation. A mailed survey to Chief Information Officers from Fortune 500 companies was carried out to assess the criticality of the 11 identified CSFs. The survey questionnaire consisted of a 5-level rating scale ranging from extremely critical and important for success to neither

critical nor important for success. 54 relevant responses were received. The five most critical factors identified were top management support, project champion, ERP teamwork and composition, project planning and change management program.

Though this study was based on empirical investigation the low number of responses can be considered as one of the limitations of the study. Another limitation of the study was conclusions were based only on Chief Information Officers' perceptions of ERP implementation CSFs. According to the authors, the importance of CSFs as perceived by various stakeholders is important for ERP implementation to be successful in the organisation.

Bancroft *et al.*, (1998) also identified CSFs for successful ERP implementation. The factors identified are top management support, the presence of a champion, good communication with stakeholders, effective project planning, re-engineering business processes and using a business analyst on the project team. Similar kinds of CSFs have been suggested by Holland and Light (1999), however these authors grouped them into strategic and tactical factors. Strategic factors included legacy systems, business vision, ERP strategy, top management support, project schedule and plan. Tactical factors involved client consultation, personnel, software consultation, client acceptance, monitoring and feedback, communication and troubleshooting.

Al-Mashari and Zairi (2000) proposed that effective deployment of SAP R/3 is determined by the extent to which certain key elements such as the business case, implementation strategy, change management and BPR are comprehensively considered and fully integrated. Al-Mudimigh *et al.*, (2001) also addressed similar issues based on an extensive review of factors and the essential elements that contribute to success in the context of ERP implementation. According to the authors, dominant factors play a major role in the implementation of ERP projects and they should be ongoing throughout all phases of

implementation. These factors are top management commitment, business case, project planning, training and change management.

In recent years, an increase in empirical research to understand ERP implementation CSFs can be observed. Mabert *et al.*, (2003) investigated on time and/or on/under-budget ERP implementations in US firms through case studies and a questionnaire survey. Based on key findings of the case studies conducted through structured interviews a questionnaire survey was developed and mailed to 270 US companies. About 75 responses, mostly from medium and large sized companies, were received. The results of the study indicated that upfront planning is a key element for successful implementation. More specifically, planning of training programs was found to be the most significant individual planning variable common to successful implementation. Further, the case study companies also emphasised the need to keep source code modifications (customisation) to a minimum as modifications in the source code lead to increased costs and implementation times. Additionally, changes in the source code makes future upgrades to the ERP system more complex. The authors further reported the following common characteristics necessary for ERP implementation success that were found in most of the case studies:

1. High involvement of senior executives
2. A cross-functional ERP steering committee with executive leadership
3. Clear guidelines on performance measurements
4. Minimum modifications to the ERP system code
5. Advanced planning of organisational change and training strategies
6. Implementations with a big bang approach took a shorter implementation time
7. Only minor re-engineering efforts were carried out up front
8. Effective communication between employers, suppliers and customers

Two limitations of this study can be seen. Firstly, only factors relating to the planning and implementation phases have been taken into consideration in the survey. Issues related to the initiation phase have not been covered in the research. Secondly, the findings from the case study are only described in brief points. The findings from case studies lacked detailed explanations for the key ERP implementation issues, for example, top management support is important but why respondents felt it was important and in what ways top management can help in ERP implementation success is not discussed.

Two case studies of large-scale ERP systems implementation, one in Australia (a petroleum company) and one in China (a large elevator company), have been reported by Shanks *et al.*, (2000) to enable cross-case comparison. Two significant similarities were observed in the cases. First, top management support was found to be important in both companies throughout all the stages of implementation. Top management was believed to provide leadership, direction, project structures and allocation of necessary resources. Second, the need for a balanced project team consisting of a mix of IT people and business people with broad understanding of the company's operation was found to be critical in most stages of implementation. Balanced project teams contributed to project success by providing a mix of people with technical skills, ERP knowledge and end-users with a good understanding of organisational processes.

However, in the above study, the cross-case comparison was carried out on two cases that were from different sectors in different countries.

Sarker and Lee (2000) found based on a case study, that strong and committed leadership, open and honest communications and a balanced implementation team are necessary conditions for successful ERP implementation. They reported that while all three factors may contribute to ERP implementation success, only strong and committed leadership can be empirically established as a necessary condition.

Portougal (2006) identified the following prerequisites for a successful ERP implementation:

1. The organisation needs to have a clear strategy of how they will implement the ERP and how the system will help in achieving the goals of the organisation.
2. From a people perspective, the need to consider implementing an ERP system on their own or in partnership with a consulting firm based on the available organisational skill, knowledge, expertise and experience.
3. From a technology perspective, the need to think about if the organisation has the infrastructure to support and implement an ERP system.
4. From a financial perspective, the need to consider not only the cost of software (license costs, annual maintenance costs) but also additional costs. For example, costs related to setting up hardware, cost of consultants, cost of training and testing costs. These costs are incurred throughout the entire project.
5. The need to involve people from grass roots and key people in the organisation who understand its business and systems.

Finney and Corbett (2007) carried out extensive and comprehensive literature review to gain a depth of understanding of the various CSFs already identified by the other researchers. Top management support, change management, BPR, software configuration, training, project team, consultant selection, planning, balanced team, project champion and communication plan were the factors that these authors found cited in the literature most frequently. These authors report that published literature on ERP implementation CSFs lack studies focusing on the identification of CSFs from the perspectives of a range of key stakeholders. Further, the authors conclude there was little or no research that included all significant CSFs considerations in a single study.

Table 3.5 summarises the CSFs for ERP implementation in large-scale firms found in extant ERP literature.

Table 3.5 - CSFs for ERP implementation in large-scale firms

Authors	CSFs
Bancroft *et al.*, (1998)	• Top management support • Project champion • Good communication • BPR • Project planning
Sarker and Lee (2000)	• Strong leadership • Balanced implementation team • Open and honest communications
Al-Mashari and Zairi (2000)	• Integration of implementation strategy, change management program and BPR
Al-Mudimigh *et al.*, (2001)	• Top management commitment • Project planning • Training • Change management program
Nah *et al.*, (2003)	• Top management support • Project champion • ERP teamwork • Project management • Change management
Umble *et al.*, (2003)	• Clear understanding of strategic goals • Commitment by top management • Excellent project management • Organisational change management
Mabert *et al.*, (2003)	• Upfront planning of training • Minimum source code modifications • High involvement of senior executives • Cross-functional ERP team
Shanks *et al.*, (2000)	• Top management support • Balanced project team
Finney and Corbett (2007)	• Top management support • Change management program • BPR • Software configuration • Training • Project team

Source - Compiled by the author

The frequency of occurrence of each CSF in existing ERP studies is illustrated in table 3.6.

Table 3.6 - Cross-reference between CSFs and ERP studies

Authors / CSFs	Bancroft *et al.*, (1998)	Sarker and Lee (2000)	Al-Mashari and Zairi (2000)	Al-Mudimigh *et al.*, (2001)	Mabert *et al.*, (2003)	Umble *et al.*,(2003)	Nah *et al.*, (2003)	Shanks *et al.*, (2000)	Finney and Corbett (2007)
Top management support	•	•		•	•		•	•	•
Project management	•			•		•	•		
Clear understanding of strategic goals						•			
BPR	•		•						•
Minimal customisation					•				•
Change management program			•	•		•	•		•
Effective communication	•	•							
Training				•	•				•
ERP team		•			•		•	•	•

Source - Compiled by the author

This section illustrates that research on CSFs has been carried out broadly. However, most of the studies are found to be lacking in the detailed description of major CSF and in representing various ERP stakeholders' perspectives. Furthermore, empirical studies covering all major CSFs in the complete implementation process are limited in number. The next sub-section discusses CSFs in SMEs to understand how they differ from CSFs in larger firms.

3.7.2.2 CSFs in SMEs

Loh and Koh (2004) identified and classified the CSFs for the implementation of ERP systems in SMEs corresponding to the phases proposed by Markus and Tanis (2000). The authors identified CSFs through a comprehensive literature review and interviews with 8 SMEs in UK (table 3.7). Through deduction and the premise that the factor had to be claimed by a minimum of five references, a list of key factors was developed.

Table 3.7 - CSFs for successful implementation in SMEs

Project phase	Critical factors
Chartering	• Project champion • Project planning • Business plan • Top management support • Effective communication • ERP team work
Project	• BPR and minimum customisation
Shakedown	• Change management program • Software development • Testing and troubleshooting
Onward and upward	• Monitoring and evaluation of performance

Source - Loh and Koh (2004)

Although this work is based upon interviews with SMEs, few details are available in the paper. For example, the SMEs sector, number of interviews, structure of interviews and information on interviewees is not given in the paper.

Both, Nah *et al.*, (2001) and Loh and Koh (2004) have used the implementation process model with corresponding CSFs to explain successful implementation process. However, other researchers have addressed CSF issues in general, not relating them to any particular phase of the implementation process.

The major uncertainties faced by SMEs during the implementation of ERP systems have been addressed by Lee and Molla (2006). Their study is based on case studies of three Malaysian manufacturing SMEs. The authors use Loh and Koh's (2004) ERP model to investigate the critical elements that Malaysian manufacturing SMEs face during ERP implementation. The uncertainties faced are funding, project leadership, project partner, resistance to change, software selection and evaluation. The study further concluded that major CSFs that were instrumental in managing the above uncertainties are top management support, project planning, effective communication, business process change, customisation, system testing and change management.

Based on Somers and Nelson's (2001) study, Plant and Willcocks (2007), examined Project Managers' perceptions of 22 CSFs as they affect the outcome of ERP implementations at distinct stages of the implementation. Further, these authors carried out two longitudinal studies over an eighteen-month period of international ERP implementations. Several methods were used to collect data including semi-structured interviews, participant observation, email updates and survey instruments. The first case company represented a small to medium enterprise based in the Caribbean (division of a holding company) and the second, a medium sized UK based company with international divisions. In the first case, the Project Manager considered top management support, clear goals and objectives and dedicated resources as the three most important factors at the initiation stage. At the midpoint, the Project Manager had changed his three leading CSFs to be top management support, project team competence and dedicated resources and he indicated that top management support, dedicated resources and management of expectations were the three most important CSFs at the end of the project. In case B, top management and vendor support were considered the key factors throughout the ERP project life. The paper further discussed CSFs that were affected by the international nature of the project. Careful package selection, vendor support, vendor partnership, access to physical resources,

software functionality and vendor-client proximity were found to be issues important for international project implementations.

Although the above study ranked CSFs according to the Project Managers' perceptions, a detailed examination of the CSFs is lacking in the paper. Only a few CSFs related to the international nature of the ERP implementations are mentioned in this study. The explanation on 'why' and 'how' other CSFs for example project planning, top management support and training are significant in ERP implementation success is not discussed in this study.

A multiple case study approach was adopted by Muscatello *et al.*, (2003) to investigate the implementation of ERP systems in manufacturing SMEs in the US. The four companies selected for the study were divisions of larger companies. Of these, two had completed implementation successfully. The experiences of successful implementation in the two firms reported that effective executive management commitment could help a project to achieve success. The research findings further showed the need for re-engineering prior to selection of the ERP. Another critical aspect for implementation success was found to be 'needs assessment'. Improper needs assessment may lead to an ERP system that may not be fit for the organisation. The needs assessment should include software and hardware requirements, management knowledge, operator education and skills audits.

Table 3.8 presents studies conducted on CSFs of ERP implementations in SMEs that are identified in existing literature and their respective research method.

Table 3.8 - CSFs in SMEs identified in existing ERP literature

Authors	CSFs	Research method
Muscatello *et al.*, (2003)	• Executive management commitment • BPR • Needs assessment	Multiple case study of four US manufacturing SMEs
Lee and Molla (2006)	• Top management support • Project planning • Effective communication • Business process change	Case study of three manufacturing Malaysian SMEs
Plant and Willcocks (2007)	• Top management support • Project team competence • Dedicated resources • Vendor support	Two longitudinal studies of Caribbean and UK SMEs

Source - Compiled by the author

To conclude, a very limited number of studies have been carried out to explain the ERP implementation process and its success in SMEs. In particular, studies of CSFs in relation to different ERP stakeholders' perspectives are absent. ERP implementation is a complex process and consistently involves top management, an ERP implementation manager, ERP team members and end-users throughout the process. Hence, an examination of CSFs from all of their perspectives is of vital importance. Furthermore, an explanation in detail of the CSFs has not been presented in the above studies. For example, studies indicate top management support is important for ERP implementation to be successful. But, how top management can help in implementation and what kind of support is expected from them is not clear. The discussion in the above sections also indicates that some CSFs (for instance, top management support) are important throughout ERP implementation and their presence affects other CSFs. Thus, studying individual CSF and merely identifying them through surveys or a small number of case studies is not sufficient to explain 'how firms can succeed in complex ERP implementation'. This clearly implies that more in-depth studies are required to investigate how the identified CSFs interact with each other and in turn can lead to ERP implementation success. Another significant limitation in the studies presented

in above section can be observed. The findings in these studies are not supported by theoretical explanations. Thus, the next chapter reviews theoretical foundations that can provide a greater understanding of ERP implementation success.

Hence, the identified gaps in the literature suggest the following specific research questions:

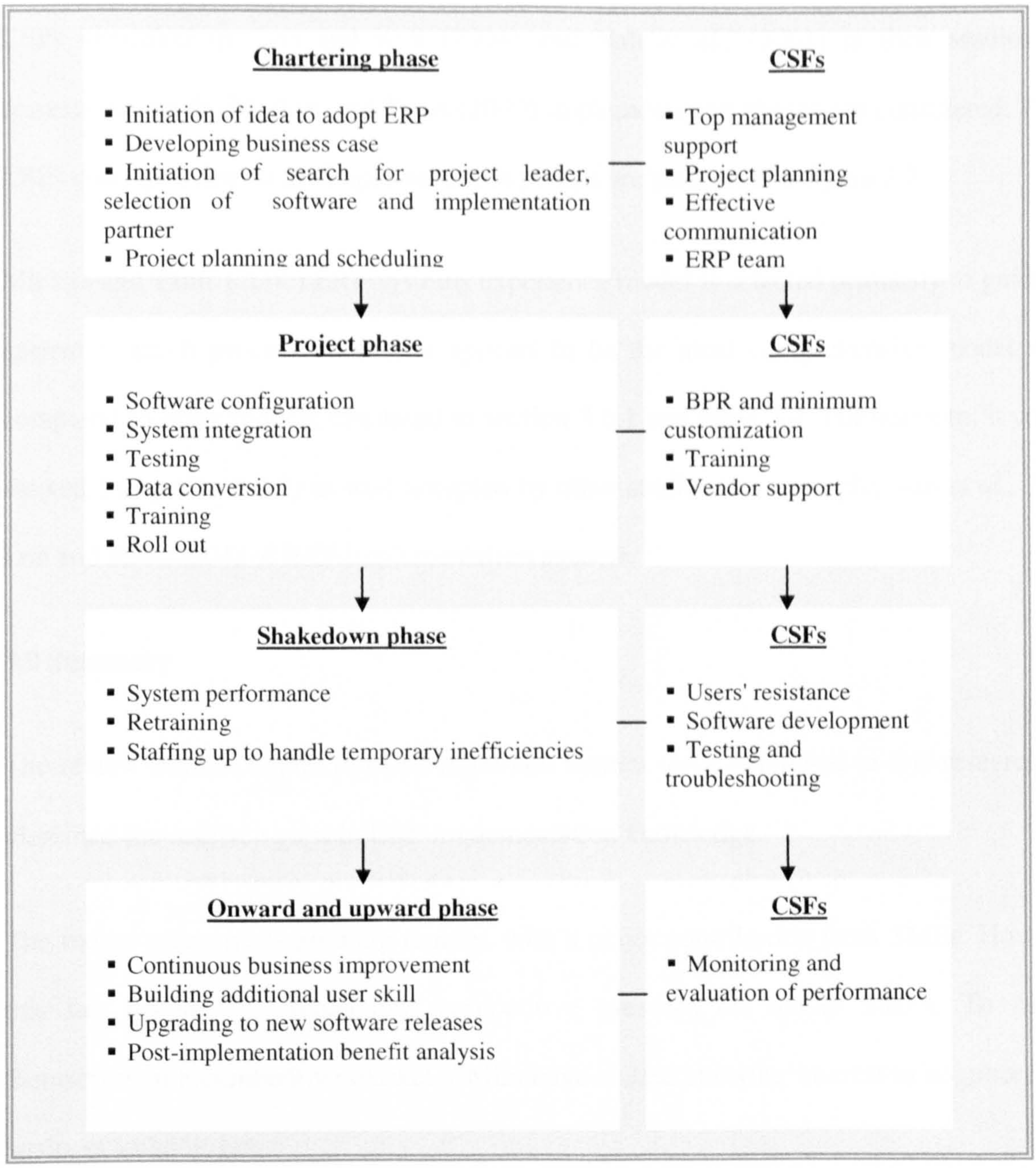
Research question 1 - How do ERP implementation strategies influence ERP implementation success in firms?

Research question 2 - How do the different factors that are critical to the successful implementation of ERP interact in order to achieve that success?

3.8 Conceptual framework

A conceptual framework is developed in this study to maintain the focus of the research on the main research objectives and to guide the research process (figure 3.2). In particular, a framework is primarily used to formulate the interview schedule and guide analysis of the data gathered in during the case studies.

Figure 3.2 - Framework indicating the ERP implementation process and corresponding CSFs



Source - Compiled by the author (adapted from Markus and Tanis, 2000; Loh and Koh, 2004; Nah *et al.*, 2001)

This framework is informed mainly by three studies, that is, Markus and Tanis (2000), Loh and Koh (2004) and Nah *et al.*, (2001). To understand the stages and sequence of activities in ERP implementation process, the Markus and Tanis (2000) process theory model is considered. According to these authors, the implementation process consists of four phases - chartering phase, project phase, shakedown phase, onward and upward phase. These

phases focus on the sequence of events that occur in the implementation process, discussed in section 3.6.1. To explore the CSFs and their importance in ERP implementation success, CSFs identified by Loh and Koh (2004) and Nah *et al.*, (2001) in their studies that corresponds to the Markus and Tanis (2000) implementation phases are considered. These CSFs corresponding to the implementation phases are presented in figure 3.2.

Markus and Tanis (2000) ERP systems experience model is selected primarily to guide the current research process because it appears to be the most comprehensive model when compared to other models discussed in section 3.6.1 and table 3.4. Furthermore, it can be viewed (in section 3.7.2) as well accepted by other studies (for example, Nah *et al.*, 2001; Loh and Koh, 2004) of ERP implementation success.

3.9 Summary

The review in this chapter covered important themes to be examined in this research and identified the research gaps in ERP implementation knowledge.

The Indian economy is growing rapidly, with a major contribution from SMEs. However, this has resulted in tremendous competitive pressure on Indian SMEs. To sustain themselves in a competitive market, SMEs have started showing interest in adoption of e-business technologies.

As an important component of e-business, ERP integrates business functional areas such as marketing, sales, production, inventory, logistics, human resources and financial management and can link suppliers and customers in the supply chain (Li and Zhao, 2006). Most organisations realise the potential of ERP systems, yet struggle to derive real benefits (Marnewick and Labuschagne, 2005).

ERP systems require large investments in terms of capital, staff and management time (Adam and O'Doherty, 2000; Umble *et al.*, 2003) and due to the high costs involved, small

businesses find it difficult to implement such systems (Yen *et al.*, 2002). SMEs usually have limited financial resources, and less technological expertise and management skills (Blili and Raymond, 1993) compared to large enterprises. These constraints make it even more important for SMEs to implement ERP successfully as it would be very difficult for them to survive failed implementations compared to large enterprises (Muscatello *et al.*, 2003). Therefore, SMEs need to identify and understand the factors that will lead to successful implementation and those factors that may inhibit such success. Both theory development and empirical studies are needed to continue the development of techniques and strategies for obtaining successful implementation of ERP projects (Martin and Huq, 2007).

Whilst many studies have explored the CSFs of ERP implementation, very few of these studies have been carried out in medium sized enterprises. Furthermore, most studies have been carried out in the US or other developed economies, with very few being undertaken in developing countries. Developing nations may face different ERP implementation issues such as inadequate IT infrastructure, governmental policies, small size of companies, lack of IT/ERP experience (Huang and Palvia, 2001) that need to be addressed.

The next chapter discusses relevant theoretical perspectives that inform this research.

CHAPTER 4: THEORETICAL PERSPECTIVES

4.1 Introduction

This chapter seeks to situate the study in a wider theoretical framework than that provided by the existing literature on SMEs and IT. Drawing on relevant management theory will provide a means of analysing and interpreting the data and findings in the study. Use of management theory will also add to the insight provided by the study by contributing to an understanding of why and how the observed CSFs contribute to successful ERP implementation, by suggesting relationships and mechanisms, hence moving beyond the descriptive nature of the extant studies in this domain.

It discusses the diffusion of innovation theory (DOI) to identify the factors that facilitate or hinder ERP technology adoption and implementation. The resource-based view (RBV) of the firm is reviewed in order to understand its applicability to explain ERP systems implementation success in medium sized firms. The concept of absorptive capacity is used to explore the relevance of a firm's existing knowledge and experience in successful ERP implementation. These theoretical views are used as a foundation for greater understanding of why only some firms succeed in ERP implementation, while others experience implementation failure.

Specifically, this chapter identifies a number of components of absorptive capacity (such as a firm's prior knowledge, technological skills, business understanding, capacity for effective planning, efficient training and effective communication processes) to understand if the existing knowledge base of firms is crucial for ERP implementation success.

Section 4.2 reviews the literature on DOI and relevant existing ERP implementation studies based on it. RBV theory is described in section 4.3 and the concept of absorptive capacity is discussed in section 4.4. Research questions to be investigated in this thesis are

presented in section 4.5 informed by the specific research gaps identified in this and the preceding 'literature review' chapter. Section 4.6 concludes the chapter.

4.2 Diffusion of innovation

4.2.1 Introduction

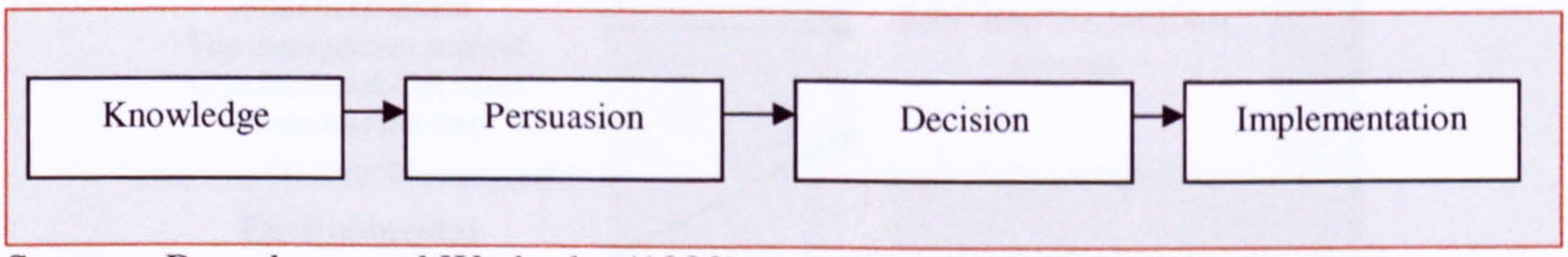
In the last decade, IT researchers have generated a stream of research focused on Everett Rogers' (1983) assessment of the process and factors important to successful DOIs in organisations. An innovation is any idea, practice or object that is perceived as new by the adopter. Innovations possess certain characteristics such as relative advantage, compatibility, complexity, trialability and observability. These characteristics determine the speed and pattern of adoption.

Since its inception, DOI research has evolved from a focus on variables affecting the adoption or non-adoption of IT (Tornatzky and Klein, 1982) to its diffusion within an organisation (Premkumar *et al.*, 1994) and organisational learning and performance (Fichman and Kemerer, 1997; Ramamurthy and Premkumar, 1995).

Innovation diffusion theory has been widely applied to the study of IT and it has provided understanding of the adoption, implementation, infusion and diffusion of IT innovations (Prescott, 1995). DOI theory can be explained in terms of its major components that is, adopter distribution over time, innovativeness and adopter categories and the individual adoption process (Brancheau and Wetherbe, 1990). Diffusion is defined as the process by which an innovation is communicated through certain channels over time among the members of a social system. The diffusion process consists of adoption and implementation stages. The adoption stage includes sub-stages of knowledge acquisition, persuasion, learning and decision leading to the actual adoption decision. As shown in figure 4.1, individual adoption can be conceptualised as a four stage process containing

knowledge, persuasion, decision and implementation. The implementation stage includes changes to task organisation, task process and technology necessary for innovation deployment (Rogers, 1983).

Figure 4.1 - Individual adoption process



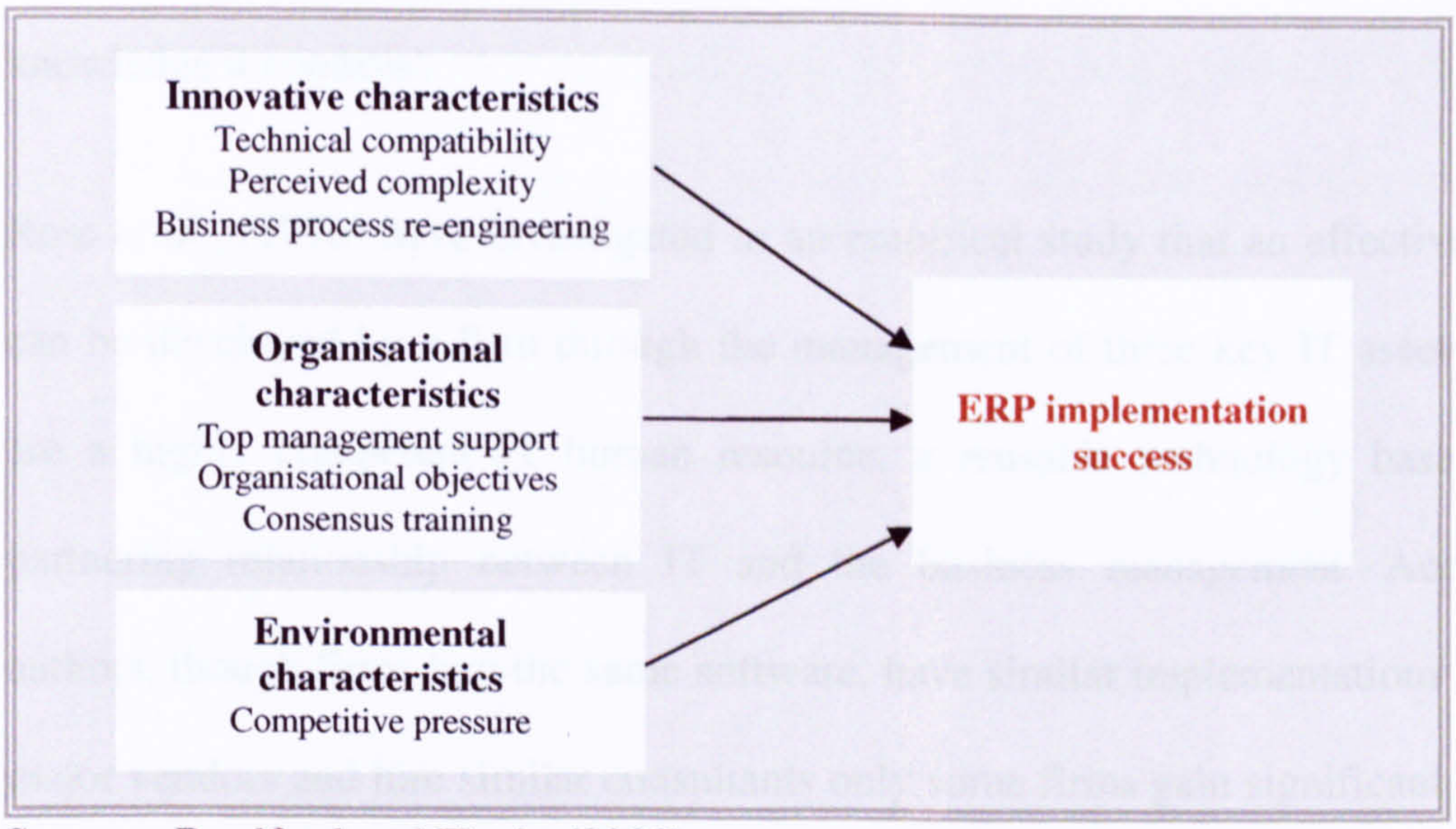
Source - Brancheau and Wetherbe (1990)

4.2.2 Innovation and ERP implementation success

Bradford and Florin (2003) developed a model drawn from two literature streams, DOI and IS success to examine the success factors of ERP systems. Taking an organisational level perspective, the authors examined the relationship between innovative, organisational and environmental characteristics and two dimensions of ERP systems implementation success: user satisfaction and perceived organisational performance. To test these relationships, a survey was administered to randomly selected members of America's SAP User Group. Of approximately 65 Managers contacted, 51 completed the survey (a response rate of 78 per cent). Results showed that the degree of consensus in organisational objectives and competitive pressure are significantly related to perceived performance. On the other hand, complexity of the system, training, competitive pressure, and top management support are significantly related to the satisfaction of functional Managers using the new systems.

In a model (figure 4.2) proposed by the authors, DOI factors (that is, innovation, organisational and environmental characteristics) will influence ERP implementation success both from a firm performance perspective and from a user satisfaction perspective.

Figure 4.2 - Model proposed by Bradford and Florin



Source - Bradford and Florin (2003)

4.3 Resource-based view of the firm

4.3.1 Introduction

The RBV theory was developed in the early-1990s. RBV (Priem and Butler, 2001; Barney, 1986, 1991, 2001; Grant, 1991; Wernerfelt, 1984) theory focuses on the internal firm resources and capabilities that can contribute to organisational competitiveness and performance.

Resources are firm specific assets that are generally rare, inimitable and nonsubstitutable that add value to a firm's operations by enabling firms to implement strategies that improve efficiency and effectiveness (Barney, 1991). For example, the individual resources of the firm include items such as capital investments, skills of individual employees and finance. Capabilities, in contrast refer to a firm's capacity to deploy resources. Capabilities are information based tangible or intangible processes that are developed over time through complex interactions among the firm's resources (Amit and Schoemaker, 1993). A capability is the capacity for a bundle of resources to perform some task or activity to produce competitive advantage (Grant, 1991). According to Barney *et al.*, (2001; 625) capabilities are 'viewed as bundles of tangible and intangible assets, including a firm's

management skills, its organisational processes and routines, and the information and knowledge it controls'.

Ross *et al.*, (1996) have investigated in an empirical study that an effective IT capability can be developed by a firm through the management of three key IT assets. These assets are a highly competent IT human resource, a reusable technology base and a strong partnering relationship between IT and the business management. According to the authors, though firms buy the same software, have similar implementations from the same major vendors and hire similar consultants only some firms gain significant business value from IT, while others do not. The difference does not lie in the reproducible technologies and skills they acquire or even the implementation processes in which these technologies are deployed, but in their ability to build and leverage inimitable IT management assets. The implication of this is that resources are the sources of firms' capabilities and may differ across organisations.

4.3.2 IS Resources and RBV theory

In the research literature on RBV, various classifications of firm resources can be found. Grant (1991) classified resources into tangible, intangible and personnel based resources. Tangible resources include the financial, capital and the physical assets of the firm such as plant, equipment and stocks of raw materials. Intangible resources consist of assets such as reputation, brand image and product quality. Technical know how and other knowledge assets such as organisational culture, employee training are personnel based resources. Barney (1991) classified firm resources into three categories-physical capital resources, human capital resources and organisational capital resources. Physical capital resources include the physical technology used in a firm, a firm's plant and equipment, its geographic location and its access to raw materials. Human capital resources include the training, experience, judgment, intelligence, relationships and insights of individual managers and

workers in a firm. Organisational capital resources include a firm's formal reporting structure, its formal and informal planning, controlling and coordinating systems, as well as informal relations among groups within a firm and between a firm and those in its environment.

Much of the RBV literature in the context of IS research attempts to identify and define either a single IS resource or sets of IS resources (Wade and Hulland, 2004). A categorisation of IS resources from previous studies are shown in table 4.1.

Table 4.1 - A categorisation of IS resources from previous studies

Resource	Source
Ability to act quickly	Bharadwaj, 2000
Capacity to frequently update information	Lopes and Galletta, 1997
Aligned IT planning	Ross *et al.*, 1996
Integrate IT and business processes	Benjamin and Levinson, 1993; Bharadwaj, 2000; Bharadwaj *et al.*, 1998
IT management skills	Bharadwaj, 2000; Bharadwaj *et al.*, 1998; Mata *et al.*, 1995
Business understanding	Feeny and Willcocks, 1998; Ross *et al.*, 1996
Problem solving orientation	Ross *et al.*, 1996
Capacity to manage IT change	Benjamin and Levinson, 1993
IT infrastructure	Armstrong and Sambamurthy, 1999; Bharadwaj, 2000; Bharadwaj *et al.*, 1998
Technical IT skills	Bharawdaj, 2000; Feeny and Willcocks, 1998; Mata *et al.*, 1995; Ross *et al.*, 1996
Knowledge assets	Bharadwaj, 2000

Source - Compiled by the author (adapted from Wade and Hulland, 2004)

Feeny and Willcocks (1998) identified nine core IS capabilities, which they categorise into four overlapping areas. These areas were business and IT vision (integration between IT and other parts of the firm), design of IT architectures (IT development skills), delivery of IS services (implementation, dealing with vendors and customers) and a core set of capabilities that included informed buying and IS leadership.

The classification of IT based resources can also be seen in the research paper by Bharadwaj (2000) who has classified key IT based resources by adopting Grant's classification scheme for resources. He defined these resources as the tangible resources involving the physical IT infrastructure components; human IT resources comprising the technical and managerial IT skills and lastly intangible IT-enabled resources such as knowledge assets, customer orientation, and synergy. Ross *et al.*, (1996) identified technical, human and relationship resources as three categories of IS resources that are critical to developing a firm's IS/IT capability. Whereas, Keen (1993) have classified resources into human, business and technology resources specifically in the IT context. According to him, the wide difference in competitive and economic benefits that companies gain from IT depends on a management difference and not a technical difference. Similar to Keen's work, Powell and Dent-Micallef (1997) have divided the resources into human, business and technology resources (table 4.2).

Table 4.2 - The division of IS resources into human, business and technology resources

Human resources
• Open communications Free oral and written communications within and across business units, chains of command and functional boundaries
• Consensus Minimal conflict in goal-setting, decision-making and action-taking
• CEO commitment A clear and visible CEO commitment to IT
• Flexibility A culture that embraces and encourages change and experimentation, minimises fear of failure and welcomes opportunities to apply new IT developments
• IT/strategy integration Integration of IT planning with the overall goals, strategies and strategic planning processes of the firm. An attempt to fit IT into strategic objectives rather than adopt ITs for their own sake
Business resources
• IT training Personnel are well trained on existing applications and IT training is a visible priority in the firm
• Process redesign An attempt to re-evaluate and re-orient traditional activities and structure along process lines, through BPR or other process-based methods
• Teams Conversion to a team-based structure or the increased use of cross departmental teams in problem solving
• IT Planning Clearly identified IT priorities and a plan for development and implementation
Technology resources
Computer hardware, software and linkages

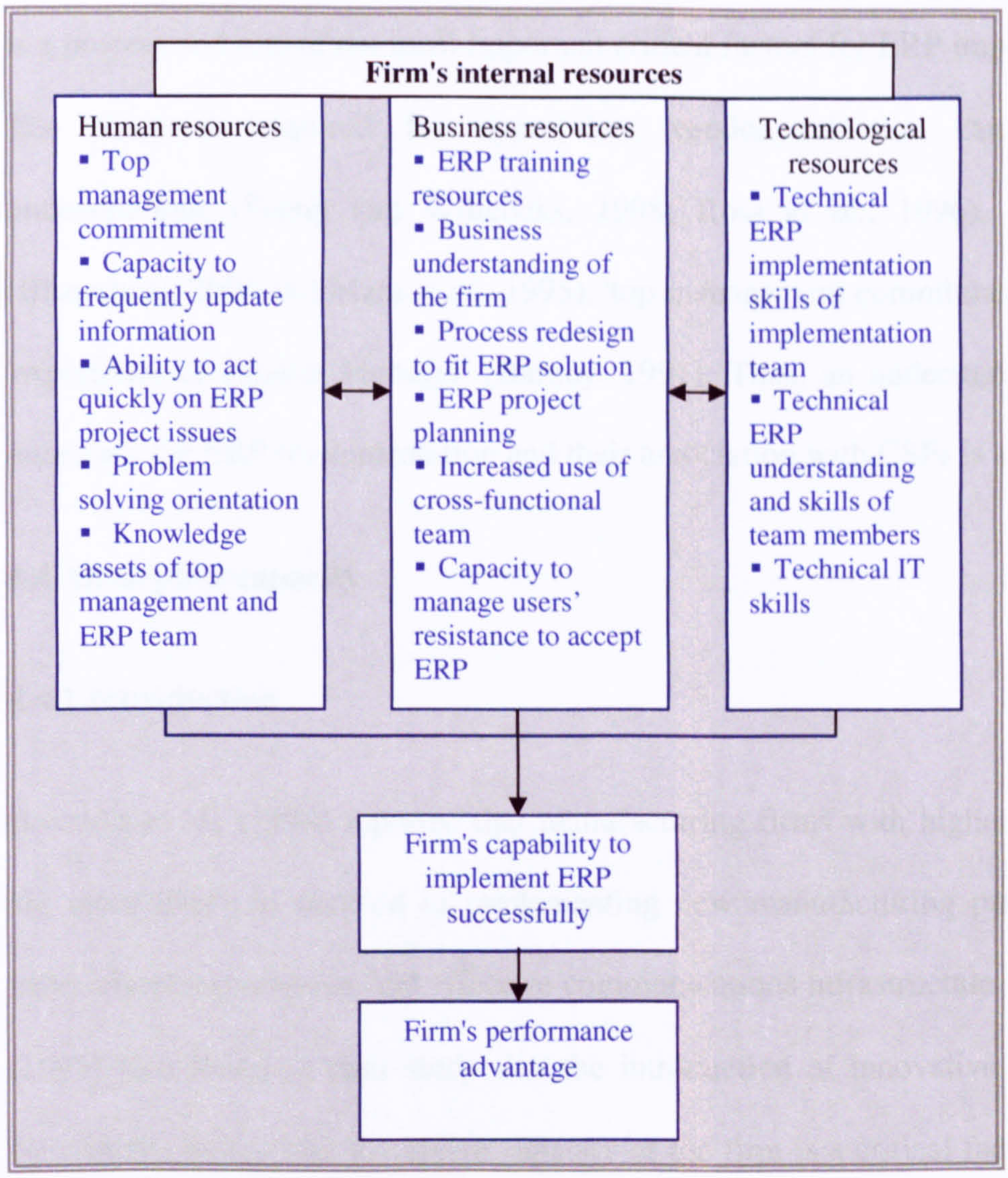
Source - Powell and Dent-Micallef (1997)

Very few empirical studies have examined the relationship between IS resources and firm performance (Rivard *et al.,* 2006). One such study has been conducted by Bharadwaj (2000). She found that firms with high IT capabilities outperformed the firms from the control group. However, Powell and Dent-Micallef (1997) found that IT resources alone do not provide competitive advantage. They suggested that firms can gain competitive

advantage by leveraging complementarity between business and human resources. Complementarity indicates improvement of resource value and occurs when a resource produces greater returns in the presence of another resource than it does alone. Complementary resources are cospecialised if one resource has little or no value with out the other (Powell and Dent-Micallef, 1997). Benjamin and Levinson (1993) have also argued that IT performance depends on the integration of resources across organisational, business and technological resources.

Figure 4.4 illustrates a proposed RBV framework to enable the interpretation and understanding of the research findings with regard to a firm's internal resources. This framework shows a division of firm's internal resources into human, business and technological resources. Although these resources are categorised based on the work of Powell and Dent-Micallef (1997), they are also informed by table 4.1 and ERP literature. Figure 4.4 also depicts, based on foregoing RBV literature, that human, business and technological resources are interlinked together to develop firm's capability to implement ERP successfully (Powell and Dent-Micallef, 1997). However, the presence of these resources and their development to form capabilities can vary across the firms, to some extent, relies upon firm's collective knowledge. The concept of firm's prior and existing relevant knowledge and its influence on developing knowledge-based capabilities is discussed in section 4.4.

Figure 4.4 - RBV framework to understand ERP implementation success



Source - Compiled by the author

4.3.3 Relationship between CSFs and RBV

Chapter 3 highlighted the key ERP implementation success factors to be studied in detail in this study. Some of these can be considered as an important firms' internal resource or a combination of resources. For example, 'capacity to frequently update information' (Lopes and Galletta, 1997) can be an important resource that is able to link to 'effective communication'. It has been discussed in the previous chapter that 'effective communication' is one of the CSFs for ERP implementation success. Similarly, 'CEO commitment' an important human resource (Powell and Dent-Micallef, 1997), is one of the CSFs discussed in the preceding chapter. Some key ERP implementation success factors can be thought of as a process or course of action, but to carry these processes effectively

and efficiently firms may need to possess unique resources. For example, 'vendor selection' is a process and one of the most important critical factors for ERP implementation success. The resources required for appropriate vendor selection can include 'business understanding' (Feeny and Willcocks, 1998; Ross *et al.*, 1996), 'technical IT skills' (Bharadwaj, 2000 and Mata *et al.*, 1995), 'top management commitment' (Keen, 1993) and 'experience of Project Manager' (Barney, 1991). Thus, an understanding of resources is necessary for ERP implementation and their association with CSFs is significant.

4.4 Absorptive capacity

4.4.1 Introduction

Boynton *et al.*, (1994) reported that manufacturing firms with higher absorptive capacity are more likely to succeed in implementing new manufacturing practices because they have related experiences and effective communications infrastructure. Levinson and Asahi (1995) also found in their study that the introduction of innovative technology includes substantial change and absorptive capacity of the firm is a critical factor for influencing if planned change can be implemented successfully.

Although the concept of absorptive capacity has recently been widely used in research, a clear definition and operationalisation of the construct needs attention (Joglekar *et al.*, 1997; Zahra and George, 2002). For example, Mowery and Oxley (1995) defines absorptive capacity as a broad set of skills needed to deal with the tacit component of transferred knowledge and the need to modify this imported knowledge. Kim (1998) conceptualises absorptive capacity as a learning capability and problem solving skills that enable a firm to assimilate knowledge and create new knowledge. According to Cohen and Levinthal (1990; 135-136), the basic character of absorptive capacity is that 'prior knowledge permits the assimilation and exploitation of new knowledge'. Zahra and George (2002) re-conceptualise absorptive capacity and suggest prior related knowledge, effective

organisational routines and communication processes are major constituents of absorptive capacity by which firms acquire, assimilate, transform and exploit knowledge. At the most elemental level, prior knowledge includes basic skills, shared language and knowledge of the most recent scientific or technological developments in a given field (Cohen and Levinthal, 1990). When organisation's members possess prior knowledge, they can absorb new knowledge more effectively (Kostova, 1999; Szulanski, 1996).

According to Cohen and Levinthal (1990; 131-132) absorptive capacity is an organisational learning concept and is the cumulative effect of constant learning. The authors, Cohen and Levinthal (1990; 131-132), highlight the following characteristics of absorptive capacity:

'...Absorptive capacity refers not only to the acquisition or the assimilation of information by an organisation but also to the organisation's ability to exploit it. Therefore, an organisation's absorptive capacity does not simply depend on the organisation's direct interface with the external environment. It also depends on transfers of knowledge across and within sub-units that may be quite removed from the original point of entry. Thus, to understand the sources of a firm's absorptive capacity, we focus on the structure of communication between the external environment and the organisation, and also on the character and distribution of expertise within the organisation'.

Cohen and Levinthal (1990) note that knowledge must be shared between employees and transferred within the firm, hence, they note the importance of what they term internal communications. The authors thus emphasise that effective communication connects the organisation and is essential for enhancing absorptive capacity and integrating functional units (Cohen and Levinthal, 1990). The authors also recognise that investments in 'advanced technical training' (Cohen and Levinthal, 1990; 129) will also increase the absorptive capacities of the employees and hence the firm.

Whilst Cohen and Levinthal (1990) mainly focus on the internal resources and mechanisms that influence an organisation's absorptive capacity, they also discuss if firms can increase their absorptive capacity from external sources (for example, hiring new staff or from technical suppliers or vendors). These authors conclude that firms can only increase their absorptive capacity from outside sources if they already have a certain degree of knowledge (existing absorptive capacity) with which they can integrate the new external knowledge.

Table 4.3 illustrates definitions and dimensions that indicate a firm's absorptive capacity in past research.

Table 4.3 - Definition and dimensions of absorptive capacity in past research

Definition	Dimensions	Illustrative studies
The ability to value, assimilate and apply new knowledge (Cohen and Levinthal, 1990)	• Ability to value knowledge through past experience • Ability to assimilate based on knowledge characteristics • Ability to apply based on technological opportunity (amount of external relevant knowledge)	Boynton *et al.*, (1994); Cohen and Levinthal (1989, 1990); Cockburn and Henderson (1998); Mowery *et al.*, (1996)
A broad array of skills, reflecting the need to deal with the tacit components of transferred technology, as well as the frequent need to modify a foreign-sourced technology for domestic applications (Mowery and Oxley, 1995)	Skills level of personnel	Mowery and Oxley (1995)

Source - Adapted from Zahra and George (2002; 188)

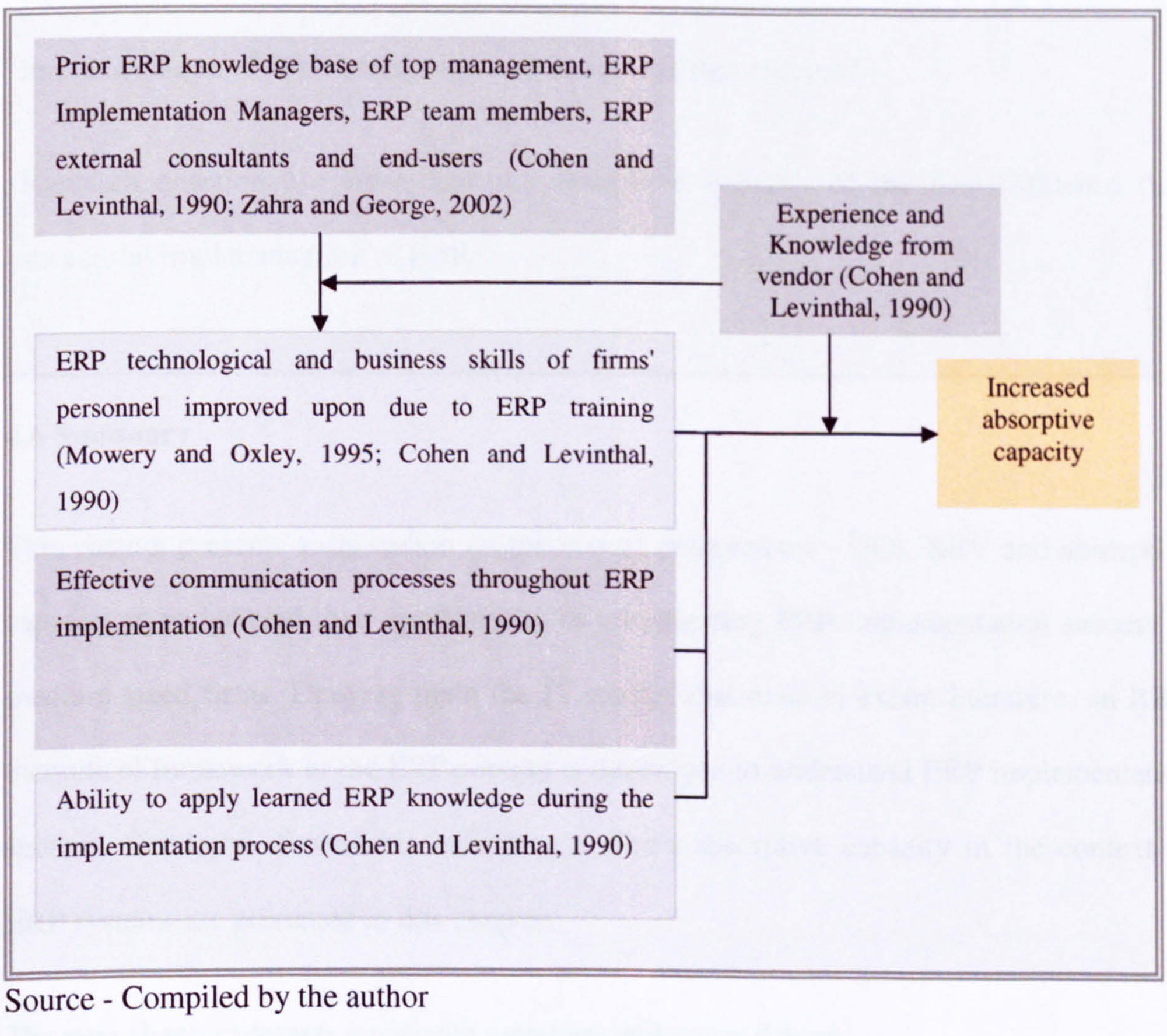
4.4.2 Absorptive capacity and ERP

Although there is a lack of empirical research on the effect of absorptive capacity in the specific context of ERP systems implementation in India, Park *et al.*, (2007) examined the effects of absorptive capacity of individual users on their ERP usage in a Korean context. Data for their study were collected from 245 users of 20 Korean companies that implemented ERP packages through structured questionnaires. The three components they studied were - users' absorptive capacity for understanding ERP systems, for assimilating ERP systems and for applying ERP knowledge were found to be positively related to their performance when using the ERP system. The first component, a user's capacity for understanding external knowledge in the context of ERP systems is the user's acquired knowledge regarding ERP systems and ERP consulting firms. The second component, a user's capacity for assimilating knowledge is the user's ability to internalise new knowledge into their task environment. The third component relates to a user's ability to use and share ERP knowledge in performing tasks. Individual users can assimilate and apply new knowledge more effectively when they have greater prior knowledge. The results also implied that the capacity to assimilate knowledge was the most challenging component for overall absorptive capacity. Therefore, organisations need to make extra efforts to have individual users understand the value and functions of ERP systems from the perspective of their individual tasks. Further, the result of the study showed the capacity to assimilate knowledge on the performance of ERP usage was stronger in firms with a higher degree of organisational support. However, this study has not looked at the absorptive capacity of other organisational members, in particular, top management and ERP Implementation Managers.

4.4.3 Absorptive capacity - dimensions

The current study thus draws upon the dimensions presented in figure 4.5 to understand if and how absorptive capacity of medium sized firm is likely to impact ERP implementation success. This figure is informed by table 4.3 and absorptive capacity discussion in sub-section 4.4. The dimensions presented in table are modified to study absorptive capacity in the specific context of ERP implementation.

Figure 4.5 - Dimensions for understanding the impact of absorptive capacity on ERP implementation



Source - Compiled by the author

4.5 Research questions

The reviews of ERP literature in the preceding and this chapter, identifies two research gaps which the objectives of this study seek to address. Firstly, 'how ERP can be

implemented successfully in Indian medium sized firms?' Secondly, 'why only some firms are able to implement ERP successfully, while others experience implementation failure?'

To address these objectives, the following specific research questions are investigated:

Research question 1 - How do ERP implementation strategies influence ERP technology implementation success in the firm?

Research question 2 - How do the different factors that are critical to the successful implementation of ERP interact in order to achieve that success?

Research question 3 - How does the absorptive capacity of the firm influence the successful implementation of ERP?

4.6 Summary

This chapter presents a discussion on theoretical perspectives - DOI, RBV and absorptive capacity to understand their applicability in investigating ERP implementation success in medium sized firms. Drawing upon the IT studies that exist in extant literature, an RBV theoretical framework in the ERP context is developed to understand ERP implementation success. Similarly, dimensions indicating a firm's absorptive capacity in the context of ERP systems are presented in this chapter.

The next chapter presents a research paradigm and methodology.

CHAPTER 5: RESEARCH METHODOLOGY

5.1 Introduction

This chapter discusses the various methodological issues to be considered when undertaking research such as the inherent philosophical perspective, the rationale behind the selected research strategy, the proposed research design and techniques employed for analysing the data.

This chapter is divided into nine sections. Section 5.2 reviews common philosophical positions regarding the conduct of research in the social sciences and IS research that inform the choice of research methodologies. The philosophical perspectives are shown to be linked to various research methods. Section 5.3 describes qualitative research methods. The research strategy and justification of conducting multiple case studies for this research is described in section 5.4. A general overview of the research process adopted in this research is presented in section 5.5. Initial fieldwork and the pilot study are described in section 5.6. Section 5.7 introduces the research design of the main study. Issues relating to the case study design and research quality are presented in section 5.8. Ethical issues considered for this study are discussed in section 5.9. The last section provides a summary to this chapter.

5.2 Philosophy of the research design

An understanding of philosophical issues is important to enable the researcher to determine the research design. Knowledge of philosophical perspectives can also suggest how to adapt research designs according to the constraints of different subjects or knowledge structures (Easterby-Smith *et al.*, 2002).

The starting point of the research process is stated to be ontology (Easterby-Smith *et al.*, 2002). Ontology means the assumptions that are made about the nature of reality as viewed

by the researcher. The ontological view of the researcher informs the epistemological stance adopted. Epistemology is a general set of assumptions about the best ways of inquiring into the nature of the world and expanding existing knowledge. A research methodology is associated with a specific ontological and epistemological view that may help researchers to select an appropriate method (Morgan and Smircich, 1980; Bryman, 1984). According to Prasad (1997), the research methodology may be regarded as an 'intricate set of ontological and epistemological assumptions that a researcher brings to his/her work'. The choice of methodology drives the selection of method. Method is the tool or technique that is used to collect data (Prasad, 1997).

Hughes (1991) states the dominant philosophical perspectives in the history of social sciences are positivism and interpretivism, although different terms may be used for these approaches. The literature suggests that these two approaches of social enquiry are opposed. Morey and Luthans (1984), in their review of literature, observe that organisational researchers have distinguished between positivism and interpretivism approaches as objective versus subjective (Burrell and Morgan, 1979), nomothetic versus idiographic (Luthans and Davis, 1982), quantitative versus qualitative (Van Maanen, 1979), outsider versus insider (Evered and Louis, 1981) and etic versus emic (Morey and Luthans, 1984). Both, positivist and interpretivist perspectives are commonly used in IS research (Walsham, 1995).Therefore, the viewpoints of these two philosophical traditions are briefly discussed in sub-sections 5.2.1 and 5.2.2.

5.2.1 The positivist approach

According to positivist science, the social world exists externally and its characteristics should be assessed through objective methods, rather than being inferred subjectively through feeling, expression or intuition (Easterby-Smith *et al.*, 2002; 28). Positivist epistemology seeks to explain and predict what happens in the social world by looking for

regularities and causal relationships between its elements (Burrell and Morgan, 1979; Morgan and Smircich, 1980). Positivists argue the label scientific by assuming things can be studied as hard facts and the relationships between these facts can be established as scientific laws. The generations of positivists within the social sciences, as suggested by social theorist William Outhwaite, 1987 (Smith, 2003; 77) are:

1. The positivist traditions of the nineteenth century pursued by Auguste Comte, Herbert Spencer and some interpretations of Emile Durkheim. The French philosopher, Auguste Comte (1853) attempted to study society as a scientific discipline. He said, 'All good intellects have repeated, since Bacon's time, that there can be no real knowledge but that which is based on observed facts'. This statement has two assumptions. First, an ontological assumption, that reality is external and objective; and second, an epistemological assumption, that knowledge is only of significance if it is based on observations of this external validity.

2. The logical positivism of the Vienna Circle (A. J. Ayer and Rudolf Carnap) in the early twentieth century. This has a strong influence in both natural and social science research. According to these philosophers, only the meaningful propositions are those that can be verified empirically.

IS research can be considered as positivist if it shows evidence of formal propositions, quantifiable measures of variables, hypothesis testing and the drawing of inferences about a phenomenon from a representative sample (Orlikowski and Baroudi, 1991). Furthermore, positivist approaches emphasise the detachment of the researcher from the object of research and simplifies the research environment through the use of closed systems (implying quantitative and experimental methods).

5.2.2 The interpretive approach

The interpretive approach argues that social science is very different from natural science and thus requires a different approach to knowledge generation. This approach considers reality as socially interpreted and subjective, where the observer is part of what is observed, with science being driven by human interests (Easterby-Smith *et al.*, 2002). Unlike positivism, human experience is characterised as a process of interpretation rather than sensory and material acquisition of the external physical world. The study of social reality requires an understanding of the social world. Hence the task of the social scientist should not be to collect facts and measure how often certain patters occur, but to find the different meanings that people give upon their experience (Easterby-Smith *et al.*, 2002).

Blaikie (1993; 48) states that 'social regularities can be understood, perhaps explained, by constructing models of typical meanings used by typical social actors engaged in typical courses of action in typical situations'. Thus, according to the interpretive philosophical viewpoint, attention is focused on the nature of meaningful social actions, through the meanings that people give and how these meanings can be understood.

The importance of the interpretive paradigm in IS research has been reported in a number of studies (for instance, Walsham, 1993; Klein and Myers, 1999; Newell *et al.*, 2002). IS research can be classified as interpretive if it assumes that knowledge of reality is gained only through social constructions such as language, shared meanings, documents and other artifacts (Klein and Myers, 1999). In contrast to positivist IS studies, those based on interpretive approaches seek to increase understanding through the examination of the research question within a specific and contextual setting from the perspective of participants (Walsham, 1995). Interpretive research can help IS researchers to understand human thought and action in organisational contexts by producing deep insights into information systems phenomena (Klein and Myers, 1999).

5.2.3 Summary

In this section, a brief discussion of interpretivist and positivist approaches is presented. The purpose of the current research is to gain in-depth knowledge of the various factors that are likely to influence ERP implementation success in the specific context of medium sized Indian firms. As discussed in the previous chapter, ERP implementation is a complex organisational process and various factors may influence its implementation success. Furthermore, the literature review identified there is lack of detailed understanding and theoretical explanation of the factors that may impact ERP implementation success. To expand existing knowledge of ERP implementation success, it is vital to draw upon shared subjective meanings of ERP success, participants' ERP knowledge, ERP implementation experiences of firms and the views and attitudes of ERP stakeholders towards ERP implementation in their firms. Thus, the current study adopts an interpretive approach.

The next section discusses the research methods that the interpretive school of thought tends to suggest for the study of social reality.

5.3 Research methods

5.3.1 Introduction

Links can be found between theories of knowledge construction and the methods used to gain that knowledge. Positivists tend to prefer to use quantitative methods (such as surveys, laboratory experiments and field experiments). They collect large amounts of empirical data to analyse statistically to find underlying regularities. Interpretivists are inclined to use qualitative techniques (such as case studies, ethnographic studies, and phenomenographic studies) as their preferred research methods (Lee, 1991). According to Walsham (1993), interpretivist research methods are 'aimed at producing an understanding of the context of the information system, and the process whereby the information system

influences and is influenced by the context'. As discussed in the above section, this research is informed by an interpretive approach, thus sub-sections 5.3.2 and 5.3.3 describes characteristics of qualitative research and some qualitative research methods respectively.

5.3.2 Characteristics of qualitative research

Van Maanen (1979; 520) defines qualitative techniques as 'an array of interpretative techniques which seek to describe, decode, translate and otherwise come to terms with the meaning, not the frequency, of certain more or less naturally occurring phenomenon in the social world'. Qualitative techniques place a greater emphasis on the subjective experiences of the researcher, the participants and the importance of social and cultural context in situating different meanings and interpretations (Iorio, 2004). This is in contrast to quantitative methods, especially surveys and experiments, where data is generally collected in artificial situations. Qualitative researchers often argue that surveys with closed questions impose the researcher's models and theories on the respondents by providing the opportunity only for limited responses to complex questions (Yates, 2004; 140). The qualitative researcher will often use different research methods simultaneously. These methods may include participant observation, in-depth interviews, focus group discussions, document analysis and archival research (Iorio, 2004).

The qualitative methods can be used for:

1. Studying in-depth particular aspects of an individual, a case history or a group's experience as the researcher has access to a wider range of material that gives deeper insights into the details of social practices.
2. Exploring how the subjects of research give meaning to their experiences and express themselves in a social context by focusing on the open ended, complex, local and specific situation.

3. Examining social events in detail in which emphasis is placed on why observed events are happening rather than how often they happen. Also they do not seek to achieve experimental closure by controlling variables of the study.

The next sub-section presents the main qualitative research methods.

5.3.3 Types of qualitative research approaches

Table 5.1 illustrates four types of qualitative research. This table shows the key characteristics such as the purpose, data collection methods, data analysis techniques and outcome of the research approaches - case study, ethnography, grounded theory and phenomenology.

Table 5.1 - Qualitative research approaches

Dimension	Case study	Ethnography	Grounded theory	Phenomenology
Research purpose	Describes one or more cases in-depth	Describes cultural characteristics of a group of people	Inductively generate grounded theory	Description of individuals' experiences of a phenomenon
Discipline origin	Social sciences Business Law Education	Anthropology Sociology	Sociology	Philosophy Sociology
Data collection methods	Multiple methods (such as interviews, observations, documents)	Extended participant observations and often interviews	Interviews with 20-30 people and observations	In-depth interviews with up to 10-15 people
Data analysis technique	Description of themes and may also include cross-case analysis	Description of cultural themes	Open coding Axial coding Selective coding	List significant statements and determine meaning of statements
Narrative form	Rich description of the context	Rich description of themes and context	Description of topic and people being studied and presents the grounded theory.	Rich description of the essential structures of the experience

Source - Adapted from Creswell (1998; 65)

Qualitative case studies are defined more by its object of inquiry (the case) than by the specific research methods used to study it. Stake (1994, 236) states that the case study 'is

not a methodological choice, but a choice of object to be studied'. The object can be an individual, a group, an organisation or even an entire community depending on the specific goals of the study. Ethnography seeks to discover and describe the culture of a group of people and it is the concept of culture that takes central importance in such studies. Unlike these former approaches, the main purpose of grounded theory is to generate and develop theory that is grounded directly in empirical data. The last approach indicated in the table above is phenomenological research. This seeks to provide a description of phenomenon as experienced by individuals. The table indicates that all four approaches have slightly different data collection methods, but interviews being common to all. Case study research differs from other mentioned qualitative approaches in its use of multiple sources of data collection.

The next section describes in detail the qualitative case study approach and the rationale for selecting qualitative case study method for this research.

5.4 Selecting a research strategy - qualitative case study method

Meredith (1998) in his paper has defined case research based on the definition by Benbasat *et al.*, (1987), Bonoma (1985), Eisenhardt (1989) and Yin (1994). A case study 'uses multiple methods and tools for data collection from a number of entities by a direct observer(s) in a single, natural setting that considers temporal and contextual aspects of the contemporary phenomenon under study, but without experimental controls or manipulations' (Meredith, 1998). The key purpose of using case studies in research is to obtain an in-depth understanding of complex phenomenon, both in and of itself and in relation to its broader context (Patton, 2002).

According to Benbasat *et al.*, (1987) in the field of IS, 'case research is particularly appropriate for certain types of problems - those in which research and theory are at their formative stages'. According to them the case study approach has the following strengths:

1. The process can be studied in its natural setting to generate meaningful and relevant theory from the understanding gained through observing actual practice.
2. The case method lends itself to early and exploratory investigations where the variables are still unknown and the phenomenon not understood.

Yin (2003) suggests that case studies are an ideal research strategy when a 'how' or 'why' question is being asked about a set of events over which the investigator has little or no control. 'How' questions are usually associated with describing relationships (previously identified by answering what questions), while the so-called 'why' questions tend to explain the reasons why those relationships exists (Yin, 1994).

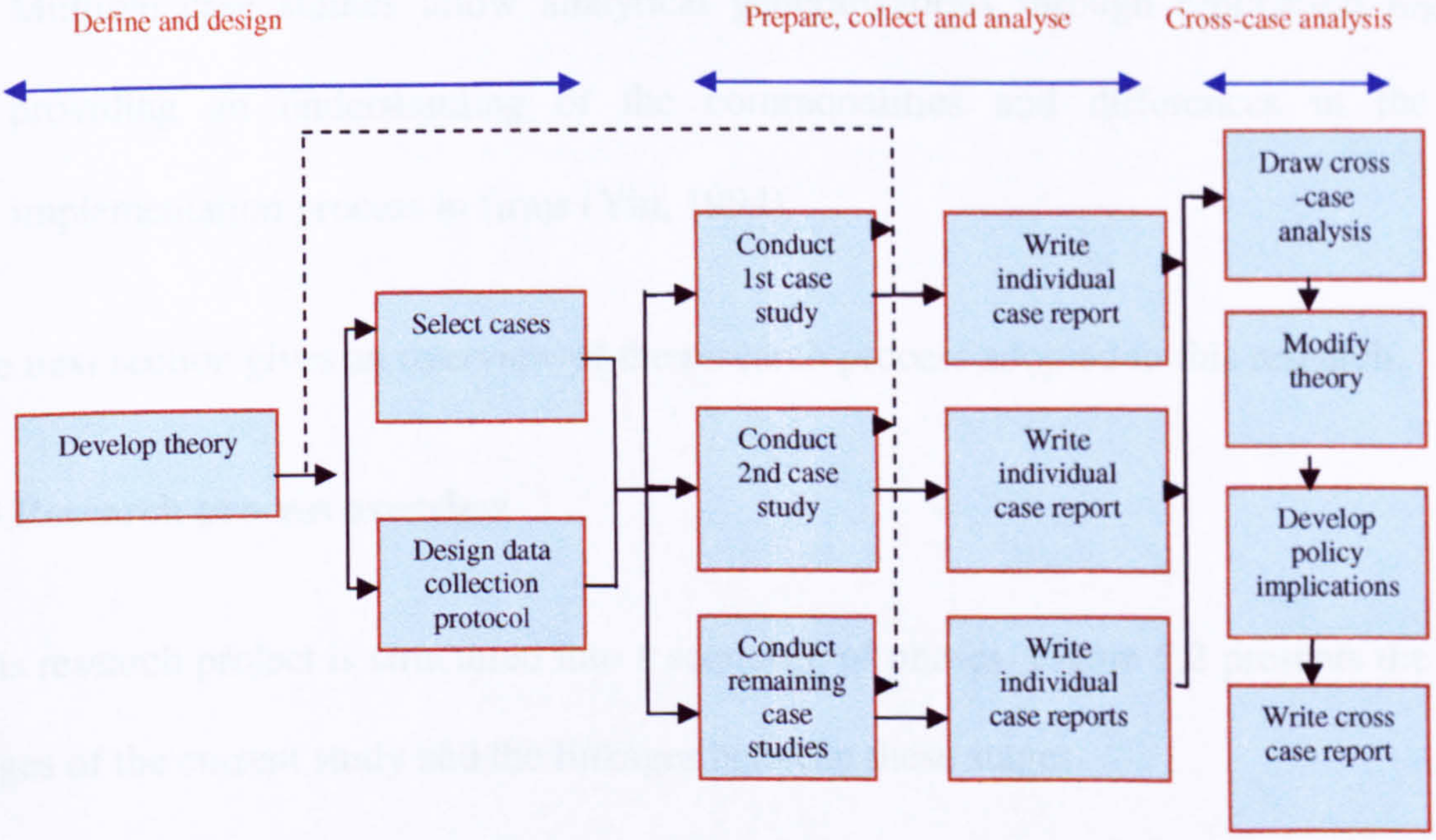
Yin (2003) also states that, case study is appropriate when the nature of the study is to understand a previously un-researched subject. However, case studies may also be used to support and expand existing theories and can do this as effectively as other methodologies that are often viewed as more rigorous (Lee, 1989).

The ideal setting for single case study is where the case represents a critical test of existing theory, where the case is rare or it represents a critical case. Multiple case study design contains more than a single case and every case should serve a particular purpose within the overall scope of study. Though multiple cases require extensive resources, the evidence from them is often considered more compelling and the overall study becomes more robust (Yin, 1994).

The advantages of case study research, in particular the ability to capture the complexity of a phenomenon within its real life context is recognised by many social scientists. However, this research strategy is also commonly criticised on the basis that the study of one or a few cases does not provide a basis for scientific generalisation (Iorio, 2004). Stake (1994) in response to such criticism argues that the aim of case study research is not to generalise to a large population of cases but to obtain an in-depth understanding of the particular case or

cases. Yin (2003) also argues that case studies provide analytical generalisation rather than statistical generalisation. As explained by Yin (1994; 10), 'case studies, like experiments, are generalisable to theoretical propositions and not to populations or universes'. In this sense, the case study, like the experiment does not represent a 'sample' and the investigator's goal is to expand and generalise theories (analytical generalisation) rather than to specify frequencies (statistical generalisation). The author further suggests that in analytical generalisation 'a previously developed theory is used as a template with which to compare the empirical results of the case study'. If two or more case studies are shown to support that same theory, replication may be claimed. The replication approach to multiple case studies is illustrated in figure 5.1.

Figure 5.1 - Replication approach to case study method



Source - Yin (1994; 56)

The above discussion suggests that qualitative multiple case studies are appropriate to explore ERP implementation success in medium sized Indian firms for the reasons detailed below.

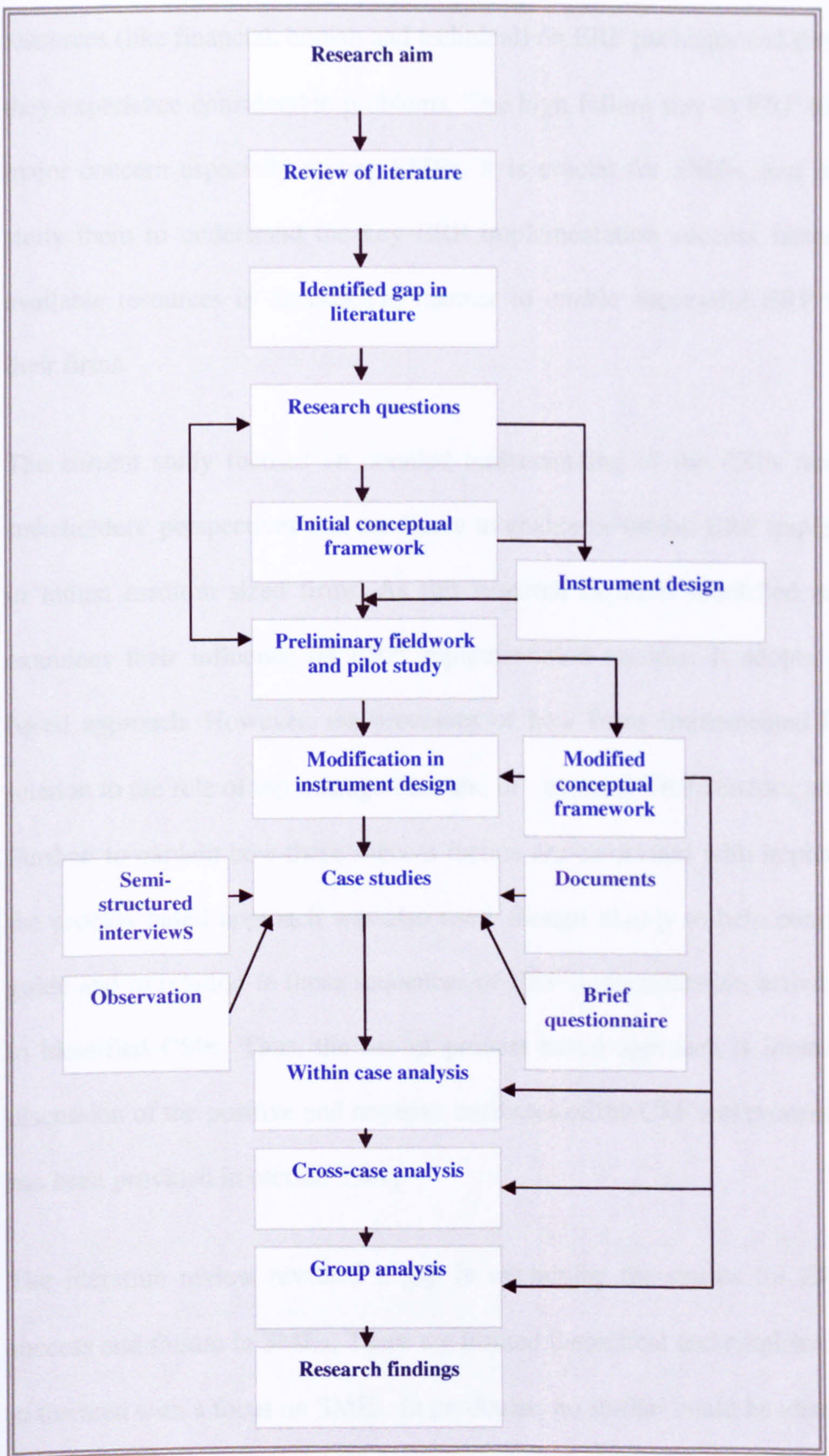
1. The previous chapter has identified a lack of empirical research studies that provide a theoretical basis for ERP implementation success and failure. As discussed in the previous section, both Yin (2003) and Benbasat *et al.*, (1987) state that case research is particularly appropriate for under - researched areas.
2. This research is focused on exploring the factors that influence the success of ERP implementation in Indian medium sized firms. The firms' specific contextual elements (for instance, resource availability, organisational knowledge and ERP vendor preference) need to be considered in exploring ERP implementation success. Case studies can provide a deep understanding on 'how' and 'why' (Yin, 1994) the different factors related to the context, content and process affect successful ERP implementation (Meredith, 1998).
3. Multiple case studies allow analytical generalisations through replication logic by providing an understanding of the commonalities and differences in the ERP implementation process in firms (Yin, 1994).

The next section gives an overview of the research process adopted in this research.

5.5 Research process overview

This research project is structured into a sequence of phases. Figure 5.2 presents the major stages of the current study and the linkages between these stages.

Figure 5.2 - Research process adopted in this research



Source - Compiled by the author

This section provides a brief overview of the research process undertaken. The following sections in this chapter then discuss the research methodology in detail.

There is evidence in the ERP literature that although companies make use of extensive resources (like financial, human and technical) on ERP packages and their implementation, they experience considerable problems. The high failure rate in ERP implementation is a major concern especially among SMEs. It is crucial for SMEs, and the academics who study them to understand the key ERP implementation success factors and deploy the available resources in an efficient manner to enable successful ERP implementation in their firms.

The current study focuses on detailed understanding of the CSFs from the firm's ERP stakeholders' perspectives that are likely to enable or inhibit ERP implementation success in Indian medium sized firms. As this research explores identified success factors and examines their influence on ERP implementation success, it adopts primarily a factor based approach. However, the processes of how firms implemented ERP, especially in relation to the role of top management and of external ERP vendors, were also examined. Further, to explain how these success factors are associated with implementation success, the process based approach was also used, though mainly to help construct the interview guide and in relation to those sequences of ERP implementation activities that are related to identified CSFs. Thus, the use of process based approach is limited in this study. A discussion of the positive and negative attributes of the CSF and processed based approach has been provided in section 3.6.1.

The literature review revealed a gap in explaining the causes for ERP implementation success and failure in SMEs. There are limited theoretical and empirical studies conducted in the area with a focus on SMEs. In particular, no studies could be identified that explored the issue of ERP implementation in Indian medium sized firms.

The preliminary fieldwork provided an opportunity to visit 11 government and private organisations associated with Indian SMEs. The primary purpose of these visits was to

collect secondary information through documents and informal discussions with senior officials of these organisations. These visits assisted in understanding the nature of Indian manufacturing SMEs and the factors that may restrain them from adopting IT. This preliminary work also helped in identifying potential firms for the main study. Based on the initial fieldwork analysis and revised theoretical views, the interview schedule was modified to ensure a focus on 'how' and 'why' only some medium sized firms experience ERP implementation success.

The main fieldwork was based on multiple case studies. The data was collected through semi-structured interviews. Data analysis begins with descriptive write ups of individual case and then followed by within case analysis. Cross-case analysis formed the basis for grouping the cases into groups which appeared to have similar levels of success with their ERP implementations. This stage of the analysis process is termed group analysis in this thesis. Consideration of the similarities and differences between the groups identified allows the research questions to be addressed.

The following sections explain the research process in more detail.

5.6 Preliminary fieldwork and pilot study

5.6.1 Introduction

The main objective for the preliminary fieldwork was to collect primary and secondary information on ERP implementations in Indian SMEs. A further objective was to identify firms for the pilot study who have implemented ERP systems either with success or failure.

Preliminary fieldwork was carried out in India between September and November 2005. The preparation and implementation of the preliminary field work included two stages.

The first stage consisted of collecting evidence of ERP implementation status in Indian SMEs and finding the contact details of SMEs who have ERP applications in their firms. In the second stage, a pilot study was conducted. The purpose of piloting was to undertake the research techniques and methods to see how well they worked in practice before commencing final phase of study (Blaxter *et al.*, 2001).

5.6.2 First stage of initial fieldwork

The following steps were taken during the first stage of preliminary fieldwork:

1. Initial contacts with senior officials of Indian organisations were established through email communication while the researcher was in UK. These are the organisations that provide financial, technical and training support to Indian SMEs. Most of them are also known to sponsor SME research projects in India. However, apart from 2 institutions, responses were not received from any other institutions. Thus, again an attempt was made to contact these institutions through telephone calls. Most of them agreed to provide time for face to face meetings and asked to confirm dates for appointment once the researcher reached India. Table 5.2 shows the officials with whom face to face meetings were conducted. In addition to meetings with the officials, several documents were gathered on SMEs and IT in general from these organisations. The libraries and websites of these institutions were also accessed. This can be considered as the first source of information collection on Indian ERP implementation process.

Table 5.2 - Institutions visited during initial fieldwork

Institutions	Location	Role of staff interviewed
Federation of Indian Chambers of Commerce (FICCI)	Delhi, India	Secretary General
Federation of Indian Micro and Small & Medium Enterprises (FISME)	Delhi, India	Joint Secretary and Secretary General
Small Industries Service Institute (SISI)	Delhi, India	Joint Secretary
The National Small Industries Corporation (NSIC)	Delhi, India	Senior Field Manager
PHD Chamber of Commerce	Delhi, India	Executive
Ministry of Small Scale Industries	Delhi, India	Deputy Director
Ministry of Communications and IT	Delhi, India	Director
Confederation of Indian Industry (CII)	Gurgaon, State Haryana, India	Principle Adviser and Executive Officer
National Institute for Entrepreneurship and Small Business Development (NIESBUD)	Noida, State U.P., India	Director
World Association for Small and Medium Enterprises (WASME)	Noida, State U.P., India	Senior Director
Noida Entrepreneurs Association	Noida, State U.P., India	Public Relations Officer

Source - Compiled by the author

Though the primary purpose of these visits and accessing libraries was to collect information on ERP implementation processes in Indian SMEs, very few documents could be found in particular on ERP. However, visits to these government and private institutions were found to be helpful in following ways:

a. They provided an initial perspective on issues, problems, advantages and stages of IT implementation in Indian SMEs.

b. Of all the institutions visited, the Confederation of Indian Industry (CII) was found to have an up-to-date database on SMEs who have implemented IT in their firms. This

organisation was visited in particular four times because it was found to have the most information resources available as compared with the libraries of other organisations.

c. They also confirmed the limitation of information resources available on ERP implementation in Indian SMEs.

d. They provided links to some SMEs who had implemented ERP systems in India.

e. During these visits, the lack of information on ERP systems and empirical studies supported the finding from the literature review that ERP implementation has not yet become very common in Indian SMEs.

2. Attempts were made to establish contact with both local and market leading ERP vendors in order to obtain their perspectives on ERP implementation in particular in Indian SMEs. Meetings were held with two personnel in local ERP vendors (E-biz frame and Sanchit) to get their viewpoints on the kind of issues that Indian SMEs face during the implementation process. Another purpose to contact the vendors was to get contacts of firms who have implemented ERP. The market leading ERP vendors SAP and Oracle were also contacted but both of them suggested that relevant information could be obtained from their websites. They declined to share implementation experiences and any information on their clients above that available on their websites.

3. Contacts were also made with previous colleagues that it was thought may be of help in accessing potential case study companies.

4. National Expo of SMEs (26 - 29 September, 2005, New Delhi, India) organised by Ministry of Small Scale Industries was attended. More than 50 Indian SMEs participated in this event providing a chance to speak to the participants and identify those which had implemented ERP in their firms.

5.6.3 Second stage of initial fieldwork

During the second stage of initial fieldwork almost 25 SMEs were contacted through telephone calls and emails to establish if they have ERP systems in their firms. This was because a comprehensive list of Indian SMEs who have implemented ERP could not be found during the first stage of the initial fieldwork.

Initial semi-structured interviews were conducted with personnel associated with ERP implementation in each of eight cases during the pilot study. Other sources of data collection included web sites, documentary evidence and a brief questionnaire.

The purpose of piloting was to test the research techniques and methods to see how well they work in practice before commencing major phase of the study (Blaxter *et al.*, 2001). In this research, the pilot study assisted in the following manner:

1. It allowed the collection of contact details for SMEs who have implemented ERP systems in their firms.
2. It developed an initial understanding of the ERP implementation process and related issues specifically in an Indian context.
3. It provided an opportunity for the researcher to test the interview schedule.
4. It developed the interviewing skills of the researcher.

The profile of interviewees and their firms contacted during preliminary fieldwork is given in table 5.3. ERP implementation success factors considered being important as informed by case study participants are shown in table 5.4.

Table 5.3 - Profiles of cases studied during initial fieldwork

	Case A	Case B	Case C	Case D	Case E	Case F	Case G	Case H
Interviewee	Head IT	Manager IT	Head IT	Head IT	Manager IT	Deputy General Manager	IT Manager	Officer IT
Number of employees	120	250	175	100	95	100	300	200
Establishment year	1994	1985	2000	1999	1986	1988	1997	1997
Industry sector	Retail and manufacturing	Retail	Manufacturing	Retail	Manufacturing	Service	Manufacturing	Manufacturin
ERP implementation	2000	2006	2001	2004	2000	2005	2001	Incomplete implementati
ERP Definition	Integrated software	Helps in optimising company's resources	Automation of business processes	Integrated solution	Integrating company's resources to get better productivity	Integration	Smooth functioning of the systems	Integrated software solution
ERP vendor	-	Wipro	SAP	Oracle	In-house	SAP	Did not provide	Local vendor
Why ERP	To link and put together different departments at different locations	To integrate all departments resources	Smooth functioning of business activities	Link up different departments	Effective working of systems	Integration with outside world, to have robust and standard system	Initiative taken by top management	Information flow from one department to another
Prior to ERP	Customised software	Departments worked in isolation	Started with SAP	Fox pro based in house system.	Module based standalone system	Manual-through s/w programs but disconnected and separate	Fox-pro	Departments worked in isolation

Table 5.4 - Factors considered important for successful ERP implementation

	Case A	Case B	Case C	Case D	Case E	Case F	Case G	Case H
Factors for ERP success	Total commitment from management Driving force Management has to initiate and take decision	Brainstorming sessions Training of users Planning and evaluation-present and future business processes	Strict approach towards lower staff Supportive top Executive Training for users Plan for future business processes or if business gets extended	Detailed business requirements must be clear Good infrastructure (system, people, efficient processors, effective information flow) Perceptions have to be changed	Driven by top management Effective training Dedicated team for the project for complete duration Good resource planning	Continuous training sessions Dedicated team Top management support Extensive planning (strategy and deployment level)	Workshops to train people Good IT infrastructure Users feedback Effective communication of project progress	Discipline approach
Major issues	Changing mindset of users	Users resistance	As a start up company, lack of standardised process How the process should be when company grow (futuristic in approach) Resistance in lower staff	Dedicated and committed team	Changing mindsets of users Adaptability of new solution Dedicated team for entire project Lack of project management techniques	Change in ERP solution	Users rigidness initially observed	Users resistance Training was given informally

Source - Compiled by the author

Only one standard interview schedule was used for all personnel during the pilot study. The pilot study showed that modified interview schedules would be required for different roles, for example, top management and end-users. Thus, in the main study three separate interview schedules were developed - for top management, Managers and end-users.

The initial interview schedule involved questions based upon ERP implementation phases and key implementation success factors associated with each phase. However, respondents stated that implementation success factors could not be categorised according to implementation phases. Thus, in the main study implementation success factors were not linked according to the ERP implementation phases.

The initial research design was modified based on an ongoing review of literature on ERP implementation and the pilot data. The research strategy for the main study was therefore informed by empirical evidence collected in an Indian context and significant theoretical issues.

Communication was maintained with these firms after completion of the initial fieldwork. Based on the willingness of these firms to be part of the main study, only two manufacturing firms from the pilot study were included in the main study. The emphasis in the main study was only on manufacturing firms in order to control for industry effects. The next section describes the research design of the main study.

5.7 Main study

5.7.1 Case selection

As discussed in section 5.4, multiple case studies are most appropriate for the current research. Yin (2003) proposed two main criteria for selecting multiple case studies. First, for literal replication, cases where similar results are predicted may be chosen. The use of similar cases replicates the theoretical explanations. Second, cases that produce contrary results may be used to allow theoretical explanations to be extended. Eisenhardt (1989) also supports the view that a random selection of cases is not necessary.

As stated earlier, the main objective of this research is to understand the ERP implementation successes and failures in Indian manufacturing medium sized firms, not to survey patterns of adoption across all sectors. Based on the criteria suggested by Yin (2003) and the research objectives, a set of nine medium sized enterprises were selected for in-depth multiple case study research. Given the focus of the study, all case studies were firms that had tried to implement ERP. As will be discussed further in subsequent chapters, these cases covered varying levels of success and failure of ERP implementation in order

to achieve a deeper understanding of the factors that may influence the implementation process. It also satisfied the criteria suggested by Yin (2003) to have both similar and dissimilar cases to achieve theoretical extensions. The profile of the cases is shown in table 5.5.

Table 5.5 - The profile of firms selected for the main study

	Establishment year	Number of employees	Industry (manufacturing)	Location
Firm 1	1985	300	Car parts	India
Firm 2	1992	200	Automobiles interiors	India
Firm 3	1985	150	Car steering system	India
Firm 4	1997	300	Medicines	India
Firm 5	1992	125	Clothing	India
Firm 6	1970	300	Cable	India
Firm 7	1997	200	Clothing	India
Firm 8	1954	180	Cable	India
Firm 9	1985	270	Sponge iron	India

Source - Compiled by the author

(Firms with similar manufacturing industry are shown in same colour)

Ten firms were willing to share general information on ERP implementation but did not wish to provide comprehensive data on ERP implementation process. These firms indicated lack of time for in-depth interviews as the main reason for declining to be a part of the study.

There were two main challenges in the process of getting access. The first challenge was to get access to firms who had the same ERP implementation manager at the time of this study as at the time of ERP implementation in firm. The second challenge was to get access to firms and arrange to interview 3-4 people from different organizational levels

involved in ERP implementation (such as top management executive, IT Manager/ERP Implementation Manager and end-users).

The next sub-section introduces the data collection method.

5.7.2 Data collection methods

Multiple data collection methods are generally used in order to obtain a rich set of data surrounding the specific research questions, as well as to capture the contextual complexity (Benbasat *et al.*, 1987). According to Yin (2003), interviews, documentation, participant and non-participant observation methods are typical sources of evidence used in case study research. In this research, supplementary information was also collected through multiple sources such as web sites, documentary evidence and direct observation in addition to the semi-structured interviews. The purpose of gathering supplementary information was to have comprehensive background information about the cases and to get a sense of organisational commitment, internal communication and levels of absorptive capacity.

Interview methods are primarily associated with qualitative research (Strauss and Corbin, 1990; Patton, 2002; Easterby Smith *et al.*, 2002). The most common qualitative method is reported to be in-depth interviewing that can be semi-structured or unstructured interviews, often with more than one interviewee in a firm or target group. The key objective of in-depth interviewing is to gain an understanding of individual's experiences, opinions, beliefs and the meanings they attach to these constructs (Patton, 2002; Crabtree and Miller, 2000).

In this study the focus is on understanding the ERP implementation success and failures from the perspective of various ERP stakeholders in Indian medium sized firms. Hence, semi-structured interviewing of top Managers, ERP Implementation Managers and end-users in each case study was the most appropriate technique for the main data collection.

All the interviews were conducted face-to-face and were held at the work sites of interviewees.

Along with an interview schedule, a brief questionnaire (attached in appendix 1) was also designed to gather background characteristics of cases and case study participants (such as establishment year, number of employees, firm's turnover, year of ERP implementation, education of case study participants, number of ERP team members and end-users).

An interview schedule for this research was developed based on the ERP literature review and the theoretical perspectives presented in chapters 3 and 4 respectively. The Markus and Tanis (2000) process theory was used as a key source for developing the interview guide. Three kinds of interview schedules were designed based on three different profiles. First an interview schedule was designed for top management (appendix 2), a second for ERP Implementation Manager/IT Manager (appendix 3) and a third one for end-users (appendix 4). The key purpose in developing three interview schedules was to gather in-depth, accurate and complete information about ERP implementation from different perspectives in each case study.

Semi-structured interviews allow an understanding of the ERP implementation process based on the perspectives of different key actors involved (top management, IT Managers, Managers, Assistant Managers, Executives, ERP Implementation Managers and ERP vendors). It also allows for a triangulation of different views of the implementation process so that a better understanding of the complex implementation process can be developed.

The data collection in the main study involved interviews with Chairman, ERP Implementation Managers, IT Managers and Executives in nine Indian medium sized manufacturing firms (table 5.6).

Table 5.6 - Case study participants in selected nine cases

Cases	Interviewees	Job titles	Interview site
Firm 1	3	ERP Implementation Manager IT Manager Executive	India
Firm 2	3	Chairman Chief Information Officer Executive	India
Firm 3	2	Head of IT Chairman and Managing Director	India
Firm 4	3	General Manager IT Manager Executive	India
Firm 5	3	Manager-Systems IT Manager Executive	India
Firm 6	3	General Manager Assistant Manager Hardware Engineer	India
Firm 7	4	Director Advisor IT Manager HR Manager	India
Firm 8	3	Director IT Manager Executive	India
Firm 9	3	Assistant Manager Manager (Electronic Data Processing) Senior Executive	India
Total	27	-	-

Semi-structured interviews provided an opportunity to explore subjective meanings of case study participants and their experiences connected with their ERP implementation process.

Researchers often use gatekeepers at multiple entry points to the research site to gain access (Patton, 2002; Marshall and Rossman, 2006). This study involved data collection in medium sized firms that have a few organizational levels. Thus the first point of contact in firms were the secretaries/receptionists based at the head offices to get contact details of secretaries of top management executives, ERP implementation Manager and IT Managers. The researcher informed the first point of contact about the general nature of study, the purpose of the study and how the data would be used.

The interviews with top management lasted between 30-60 minutes. ERP Implementation Managers' interviews continued for about 90 minutes. The interviews with the Executives (end-users) were about 45-60 minutes in duration. Except for three interviews, all others were audio-taped with the permission of participants and transcribed for analysis. Detailed notes were taken where interviews were not tape recorded.

In firms 1, 3 and 4, ERP was introduced between 2001-02 and in firms 2, 6, 7 and 8 it was introduced between 2004-06. Data collection was undertaken with the nine case study firms between 2005-06, thus there was not a significant time gap between participants' interviews and ERP implementation in these firms. In firms 5 and 9, ERP was implemented between 1999-2000. Of these, in firm 9, though ERP was initiated in 1999, attempts were still being made to make ERP successful in 2006. However, whilst the time gap between ERP implementation and when the interviews conducted was not great, the following possible adverse effects should be recognized:

1. Memory lapse of interviewees leading to an incomplete or faulty account of the ERP implementation process.
2. False memory where the interviewee has introduced or removed (not necessarily intentionally) important critical elements or 'tidied' up their account of what happened, influenced by a desire to present a more positive image (for example, to appear to be more in charge of events; more wise; more decisive).

In order to reduce the possibility of the above effects, data was collected in each case from multiple respondents using in-depth interview schedules and where possible augmented with other sources of data such as company documents.

5.7.3 Data analysis

5.7.3.1 Introduction

"The key issue in selecting and making decisions about the appropriate unit of analysis is to decide what it is you want to be able to say something about at the end of the study" (Patton, 2002; 229). The objectives of the research presented in this thesis are to explore how ERP can be implemented successfully in firms and to understand why only some firms are able to implement ERP successfully, while others experience ERP failure. Thus, there is focus on the organisation as the unit of analysis in this study. In this study, multiple interviews were conducted and observation was used to informally validate findings in each case study firm. In all firms, uses of different data collection sources triangulate the views of interviewees and informed views of the firm. Thus, multiple interviews (in each firm) provided different perspectives on the ERP implementation process and data collected are used as aggregate information about each firm.

Although the researcher has undertaken training in N6, storage and qualitative data analysis of the interview transcripts and other items of data was undertaken using a word processing package. Reading and re-reading the data both on screen and on paper, and annotating and sorting the data by multi-coloured highlighting pens were chosen rather than use of software packages available for qualitative analysis. This method was chosen since it was found to be effective by the researcher and also decreased the possibility that the "availability of computer analysis may lead to an emphasis on counting the frequency of categories, at the expense of understanding the quality of ideas and experiences" (Easterby-Smith *et al.*, 2002; 129).

Sub-section 5.7.3.2 describes within case analysis. Cross-case and group analysis are described in sub-sections 5.7.3.3 and 5.7.3.4 respectively.

5.7.3.2 Within case analysis

Eisenhardt (1989) suggests within case analysis as one of the key steps in multiple case study data analysis. The overall concept of individual case analysis is to obtain an initial impression of each case. A close reading and re-reading of the transcripts was done to develop an initial sense of individual cases (deWet and Erasmus, 2005). The interview transcripts were then coded focusing on the research questions. According to Miles and Huberman (1994; 56) coding can be referred as 'tags or labels for assigning units of meaning to the descriptive or inferential information compiled during a study'. Coding in this thesis involved assigning unique labels (informed by the research questions) and categories to selected text passages. This process of selecting a bit of data and assigning it to a category leads to data fragmentation (Dey, 1993; 62) and data reduction (Miles and Huberman, 1994; 11; Fielding and Lee, 1998; 41). Coding helped in bringing together selected field data and organising it for writing up of individual cases.

Therefore, in this research within case analysis involved detailed write-ups for each of the nine cases. Within case analysis provided an opportunity to gain familiarity with each case that in turn accelerated cross-case comparison (Eisenhardt, 1989).

5.7.3.3 Cross-case analysis

Within case analysis was followed by cross-case analysis. The cross-case analysis provided an opportunity for explanation (Gable, 1994) guided by the theoretical views. Eisenhardt (1989) suggests for good cross-case comparisons, select dimensions or categories to look for within group similarities together with inter group differences. Thus, cross-case comparison was conducted based on certain dimensions for example, level of implementation success, implementation strategy and key implementation success factors. With the help of analytical tables (Miles and Huberman, 1984), these dimensions were analysed in detail across the nine cases. This enabled the researcher to understand

implementation success factors and the differences in their influence on ERP success and failure in firms. The cross-case analysis aided in putting the cases into groups based on similarities and differences in the ERP implementation process.

5.7.3.4 Group analysis

Groups were formed based on the cross-case analysis. Three groups were defined according to the different assessed levels of ERP implementation success and failure in the nine cases. Table 5.7 shows the parameters used for grouping the cases in the study. These parameters are selected as implementation success measures informed by the ERP literature review (chapter 3, sub-section 3.7.1). The primary purpose of group analysis was to observe replication of information among successful and unsuccessful implementations to allow possible theoretical explanations.

Table 5.7 - Parameters for grouping the cases

ERP implementation within schedule time	**ERP implementation within initial planned budget**	**ERP benefits**	**Users' satisfaction**

5.8 Research quality

Data collection and analysis techniques in qualitative case research are subject to the influence of the researcher's characteristics and depends on the researcher's interpretation of events, documents and interview material (Galliers, 1992). Yin (2003) proposes that addressing the issues of construct validity, internal validity, external validity and reliability improve the validity and reliability of the case study research. The measures taken to increase the validity and reliability of research are discussed within the context and objectives of this study in the following sub-sections.

5.8.1 Validity

Construct validity is concerned with defining the appropriate operational measures for the concepts being studied. Yin (2003) suggests construct validity can be increased through the triangulation of data (use of multiple sources of evidence). Thus in the current study, the issue of construct validity was addressed by using multiple sources of evidence to have in-depth understanding of the ERP implementation process in Indian medium sized firms. Multiple sources of data collection such as documentary evidence, websites, observation, brief questionnaire and in-depth interviewing were used. Further, in each case study, collecting information from 3-4 participants through in-depth interviewing added accuracy and validity to the case study data.

External validity is concerned with achieving generalisation of findings through case study research. However, Yin (2003) argues the number of cases studied is not relevant in case research design because case studies do not provide statistical generalisation. Instead, they look for analytical generalisations. According to Yin (1994; 36) 'in analytical generalisation, the investigator is striving to generalise a particular set of results to some broader theory'. In this thesis, the use of multiple cases has enabled the testing of a theory through replication of the findings in other cases. Furthermore, the findings were analysed based on the existing theory to improve their external validity.

5.8.2 Reliability

Reliability concerns proper execution of the procedures, so that another researcher can obtain similar results if a replication study is carried out. Reliability is a concept known to be closely related to validity. Validity is focused on the meaning and meaningfulness of data while reliability focuses on the consistency of results (Patton, 2002).

In this study, reliability is achieved in a number of ways. Firstly, a semi-structured interview schedule was used based on a standard format. Secondly, interviews were audio-taped and fully transcribed. Additionally, in some cases, field notes were also taken during the interviews. All this information and the detailed process of data collection is stored and available for future reference. Finally, the entire research process is made transparent through the extensive use of quotations, tables and figures from the data (Skykes, 1990).

5.9 Ethical considerations

Ethical issues occur mostly with research designs that use qualitative methods of data collection (Blaxter *et al.*, 2001; 158). A number of following measures were taken to address ethical issues in this research (Bell, 2002):

1. All the participants were informed about the purpose of the conducting research before initiating collection of field data.
2. All the participants were informed about the process of collecting data:
    a. Brief description was provided to interviewees before the interview of the questions in semi-structured interview schedule
    b. Only if participant agreed were interviews tape recorded
    c. Consent was obtained before making any observations
    d. Participants were given a right to refuse if they do not want to provide answers to any of the research questions
    e. Participants were given a right to withdraw at any time during the interview
3. Participants were assured that their and their firms' names would be kept anonymous in the thesis.
4. Participants were assured that all data collected would be treated as confidential.

5. Participants were offered the opportunity to read the transcripts of their own interviews.
6. Participants were offered the opportunity to have a copy of the final findings of the study.

5.10 Summary

This chapter described the design and implementation of the empirical work. It presented a discussion on how the research methodology links the research objectives and theoretical perspectives with the research method. Two main research paradigms - the positivism and interpretivism were introduced. This research is based on a qualitative approach and multiple case studies were carried out in nine medium sized firms. In this research, data was collected through multiple sources such as documentary evidence, brief questionnaire and direct observation. The research process consisted of a selection of cases, collection of data through phased fieldworks (based on the perceptions, comments, experiences expressed by the case study participants, information from secondary sources and from the researcher's observation), within case analysis, cross-case analysis and group analysis. A number of relevant measures and precautions were taken to improve the validity and reliability of the research process.

In the next chapter case summaries are presented.

CHAPTER 6: CASE STUDIES SUMMARIES

6.1 Case study 1

6.1.1 Introduction: firm's background and ERP implementation status

Firm 1 was established in 1985 and produces seating systems for India's leading automobile manufacturer, Maruti Udyog Limited. It has only one manufacturing plant in Gurgaon (in State Haryana), India. In December 2006, this enterprise employed about 300 people and had an annual turnover of around 2.0 billion INR (approximately 30 million GBP).

The aim of this firm is to provide an efficient and comfortable seating pattern, and its main customer, Maruti Udyog Limited, is situated adjacent to the firm. Since its foundation, the firm has been constantly growing. Proven Japanese total quality management theories (Kaizen) have been adapted to the Indian environment. Under the Just in Time (JIT) concept, the delivery schedule is worked out such that the seating units are delivered to the assembly lines of manufacturer (Maruti Udyog Limited) as they are required. To a great extent the delivery of the seating systems on a JIT basis has been possible through the successful ERP implementation undertaken in 2001. Real time information was a key part of this firm's capability to optimise its complex seating production processes to get on time and increased productivity. The ERP system was a key part in providing that real time information.

Management started to look for an integrated ERP software solution to plan, manage and control the manufacturing processes of the firm in early 1995. Between 1996-97, the firm attempted to implement an ERP system with a local ERP vendor but it never went live successfully. The ERP software available from the local ERP vendor did not suit the company's business processes. Thus, extensive customisation was undertaken that could

not be completed successfully. However, the unsuccessful implementation in 1996-97 has provided the management with valuable lessons and useful knowledge about its ERP requirements. It was realised by the management that suitable vendor selection and extensive project planning is a must for an ERP project to be a success. The lessons learned helped it in successful ERP implementation in 2001.

According to the IT Manager,

> *The earlier ERP system resulted in failed implementation mainly because of frequent changes in the source code due to extensive customisation required in the ERP software programmes from the local ERP vendor. Due to unsuccessful customisation, the ERP system was not integrated into one solution and it never went live successfully.*

During the earlier implementation, the ERP team did not possess the relevant knowledge that significant customisation could be one of the factors responsible for unsuccessful implementation. However, management was keen to begin ERP implementation for a second time in their firm. In October 2000, the Managing Director personally took responsibility for implementing ERP again. This time it was implemented in six months and went live successfully in the organisation on 1st April, 2001 with the assistance from a well-known ERP vendor BAAN. The firm has chosen a well-known vendor the second time because of the earlier unsuccessful implementation experience with a local vendor. Three modules; finance, manufacturing and distribution have been implemented in the firm.

The firm adopted a big bang ERP implementation strategy on the second time mainly because in this strategy the whole organisation can be made aware of the ERP technology at the same time and the same ERP team members can work together through the whole implementation period. Having the same implementation team is difficult in step-by-step

implementations because they are spread over longer periods compared with a big bang strategy.

In firm 1, ERP investments were calculated in detail. For example, software costs, infrastructure costs, training costs were looked into in consultation with the implementation partner (vendor's team). However, the return on investment was not calculated because it was not possible to find out if the returns were due to ERP alone because, at the same time, other management techniques like Kaizan were also being introduced.

The ERP Implementation Manager stated that the ERP implementation process consisted of the following key steps:

1. Decision to implement ERP was taken by the Managing Director
2. Selection of an experienced vendor (BAAN)
3. Identification of ERP team members
4. Detailed ERP project planning
5. Mapping of existing business processes in the firm
6. Installation of both hardware and software
7. Training of ERP users
8. Testing of ERP system
9. ERP system live

A summary of the firm's characteristics and implementation status is presented in table 6.1.

Table 6.1 - Summary of firm's characteristics and ERP system

Year of establishment	1985
Number of employees	300
Annual turnover	2 billion INR (approx. 30 million GBP)
Industry	Car parts manufacturing
Year of ERP implementation	2001
Implementation duration	6 months
Estimated ERP cost	60 lakhs INR (approx. 72,000 GBP)
Implementation approach	Big bang
ERP vendor	BAAN
Project champion	ERP Implementation Manager
Project team members	12
Number of end-users	20
ERP modules implemented	Finance, manufacturing and distribution
Status of ERP modules	Gone live
Configuration	Completed
Manual or legacy system in use with current ERP	No
Business operation after ERP implementation	Smooth
Upgrade to next ERP release	Planning
Interviewees	ERP Implementation Manager (project champion), IT Manager and Executive (finance)

Source - Compiled by the author

6.1.2 Level of success

All the three interviewees, ERP Implementation Manager, IT Manager and Executive (finance) agreed that the ERP system is running successfully in the firm. The ERP implementation process is viewed as a complete success because it was implemented within the estimated time and has helped firm to reduce the production cycle time. Also, the interviewees indicated that the firm is getting the desired end results from the ERP

systems implementation in terms of benefits such as reduced inventory, cost savings, and JIT delivery of products (table 6.2).

According to the ERP Implementation Manager,

> *...Inventory costs have been significantly reduced after implementing ERP and labour costs have been reduced as the production of seats that was completed in two shifts can now be completed in one shift only. Definitely seating production cycles have been reduced and production capacity has been increased.*

Table 6.2 - Implementation success indicators

	Full implementation success	Limited implementation success	Implementation failure
Time schedule	Maintained		
Budget utilisation	As planned		
Users' satisfaction	High		
Benefits	Highly improved production process		

Source - Compiled by the author

The CSFs described by the ERP Implementation Manager, IT Manager and Executive (finance) are presented in the next section. The ERP Implementation Manager acted as the ERP project champion. He has computer engineering degree along with a management degree from one of the premium institutes of India. The role of the ERP Implementation Manager in the firm was to co-ordinate ERP project activities between the internal ERP team members, top management and the external ERP implementation partners (vendor's team members). His role was to take major strategic and financial decisions related to the ERP project in consultation with top management. The IT Manager also had technical background and headed the IT department of the firm. The Executive (finance) was an end-user and active team member during the ERP installation.

6.1.3 Critical success factors

6.1.3.1 Introduction

In the following sub-sections, the field data on key ERP implementation success factors is presented.

6.1.3.2 Top management support

The ERP Implementation Manager, IT Manager and Executive (finance) expressed in their interviews that the Managing Director's support and encouragement was critical from the start of the project. Top management had seen other firms gaining advantages from ERP systems and therefore they wanted to implement ERP successfully in their own organisation to get maximum benefits from it. Top management had shown interest in the ERP implementation process, assisted in the vendor selection process and reassigned the work of the ERP team members so they could focus on the implementation. An appointment for an emergency meeting with the Vice President or Managing Director was usually available to discuss ERP related issues requiring immediate attention. Especially during ERP vendor selection process, frequent meetings took place with top management. Top priority during implementation was for senior management to solve emerging issues and they always gave their time. The top management sought to solve issues as quickly as possible in order to have an on-time and smooth ERP implementation.

The ERP Implementation Manager expressed his views,

The initiative was taken by the top management (Managing Director)...there was a weekly update to the management but management intervened frequently as certain issues came up from time to time. For example, to reassign work of ERP team members or for defining budget for hardware purchase etc.

The firm's IT Manager also had similar views,

> *...Top management ensured that project activities are on time as indicated in the project plan and ensured employees of the organisation supported the ERP implementation decision till the implementation finished.*

To accomplish the objective of successful ERP completion on time, daily meetings were held among all Head of Departments along with the 12 ERP project team members and top management was updated on a weekly basis. Even if there was no important matter to be discussed meetings were conducted even if for only 10 minutes, to ensure project timelines were being followed. All meetings were formal and recorded. Weekly review meetings were held between the implementation partners, top management and team members and lasted for about 10-40 minutes.

6.1.3.3 ERP team

The IT Manager and user both stated that their project champion had a very good understanding of business processes and had a good technical background. He also had implementation experience. His commitment towards the project encouraged other ERP team members and developed a positive attitude among employees of the organisation.

Furthermore, both the ERP Implementation Manager and the IT Manager described the importance of selecting a suitable in-house ERP team. According to the ERP Implementation Manager selecting dedicated in-house ERP team members was critical for ERP success. Twelve ERP team members responsible for carrying out particular activities were selected. Dedicated team members were chosen based on interviews. The main criteria for selection of team members were their IT knowledge, interest, approach and attitude towards the implementation of new technology. Further, emphasis was placed on

how much respect others gave to these team members, so that team members can gain the support of other employees during the implementation process.

Team members were dedicated to the ERP implementation, hence only involved in ERP project work tasks. According to the ERP Implementation Manager,

> *...These team members were only involved in ERP project and did not perform any other office work that they were involved in before. Their commitment made implementation finish on time.*

It was stressed to the external implementation partners that as far as possible, the implementation team should remain same throughout the implementation. Also, top management ensured that the in-house team members kept themselves involved in the implementation. Team members were told that no leave would be granted except in emergency situations for the duration of the implementation. In response to this team members worked dedicatedly and did not ask for any holidays during that period. The ERP Implementation Manager felt very proud during his interview that everyone in the organisation worked together to make the ERP implementation a success.

The IT Manager stated,

> *Commitment and dedication was shown by everyone because they all wanted ERP to be a success. Because they had knowledge that through ERP increased levels of efficiency can be seen, that is why user resistance was also not observed at all in our organisation.*

6.1.3.4 Project planning

Top management, the ERP Implementation Manager and the IT Manager jointly developed a formal project planning structure. Most of the ERP project activities and estimated time

frame for their completion was planned. Top management helped in assigning the project activities to the ERP team members and other individual members. Top management got involved in this planning so that resistance from personnel to accept their assigned duties would be minimised. The main concern was that the production process should not be affected if the implementation was not smooth. To ensure this, contingency plans were also made.

The ERP Implementation Manager provided the following view,

> *The top management of this firm emphasised the importance of project planning. Thus even small project activities were thought of and time was spent in planning and assigning responsibilities to ERP team members. Meeting schedules with the implementation partner and steering committee members were also tentatively planned.*

6.1.3.5 Vendor selection process

Both the implementation Manager and the IT Manager had similar views on the importance of the selection process of the vendor. The implementation Manager explained that due to the earlier failed implementation by a local vendor, a decision was made to select a well-known ERP vendor this time, because well-known ERP vendors have wide experience with different firms and can provide opportunities to select software solutions that best suit the way a business functions. In this way extensive customisation can be avoided. Three ERP vendors (SAP, BAAN and Oracle) were compared. These three vendors were studied in detail. Interviewees stated that the following factors were given priority in selecting one vendor out of these three vendors,

a. Proximity to their implementation partners

b. Successful implementation record

c. Available programmes for manufacturing sector especially for a similar types of firms

d. Presentations made by these vendors

In addition to these factors, sites of customers of the implementation partners of the above mentioned ERP vendors were visited. These visits were made separately by the top management and the ERP team members. This shows their careful vendor selection process and their understanding of the importance of the vendor selection process.

6.1.3.6 Communication

All the case study participants mentioned that communication with employees and among the ERP team members of the firm were maintained during the process of implementation. An update on project progress was delivered on a regular basis to all ERP team members through regular meetings, web site and email. Presentations were also made to the firm's employees to inform them of the process and benefits of successful ERP implementation.

Users were considered a significant part of the implementation process and thus effective communication was maintained with the users throughout the ERP implementation through formal and informal meetings. They were involved in various project tasks to increase their interest in the implementation. This contributed to almost no user resistance to the ERP implementation.

Thus in this firm effective communication was undertaken at three levels:

a. Among ERP team members

b. With users

c. With employees not directly involved with ERP implementation process

6.1.3.7 Business process re-engineering and customisation

Business processes of the firm were studied in detail by the implementation team. The IT Manager and the implementation Manager shared similar views on customisation, that is, ERP customisation could lead to delay in the project and additional costs. Thus, due to their earlier failed implementation experience, customisation was done to about only 10-20 per cent of the system. To avoid customisation, a BAAN ERP package similar to the firm's business processes was selected. Therefore, only few minor changes in business processes were made, rather making major changes to the software programmes.

6.1.3.8 Training process

All three interviewees emphasised that training was a planned and systematic effort in this enterprise. Both the IT Manager and the users were satisfied with the training they received. The content of the training had been designed separately for the IT Manager, head of departments and the key users. Further, providing dedicated space for training shows management commitment to the ERP training process.

The IT Manager explained,

> *From the start, a separate training area was made. One portion of empty premises was converted into a kind of training institute. Training was conducted separately for head of departments and key users. It was official training and it was made compulsory to come for the training.*

Key users for the training were selected from relevant fields like production, finance and distribution based on the following criteria:

a. Should have knowledge of the business processes

b. Have capability to provide training to others

c. Respected among other office staff for their knowledge

These key users were trained in such a way so that they could train other end-users. The training period was for about 1-3 weeks depending on learning capabilities and the earlier knowledge of learners. Training content included both technical and functional knowledge.

The Executive (finance) noted,

> *All the users attended training everyday...I took an interest and learnt the fundamental ERP training given to us. I am from the finance department and I was given functional training not only relevant to my finance department but also how the ERP system will be linked with other departments' business processes. All those undergoing training were asked to practice as even one wrong entry can affect the whole system operation...*

Apart from training, two presentations (each about one hour long) were made for others not involved in the implementation process directly. These presentations included very simple information on how ERP can impact the different departments of the organisation like production, accounts, distribution and pricing. Most of the doubts and issues raised by the staff were answered. They were all made confident that ERP deployment was a must for the organisation's growth and to increase work efficiency of staff members. Both the presentations were attended by the General Manager and Heads of all departments. The case study participants indicated the main purpose of this was to make employees of the firm feel that they were part of the ERP project from the initiation of the project. It helped in increasing the level of willingness to accept new technology in the firm.

6.1.3.9 Other key success factors

All the three interviewees stated that there were no critical uncertainties faced such as insecure funding, improper software selection, ineffective communication, non committed

project partners, poor project planning and poor team work during implementation. However, a few other issues were faced once the ERP went live in the organisation. According to the Executive (finance) the first two weeks after ERP went live were difficult because the old system was completely stopped. All the data and entries had to be put in the new system and users took some time to get used to new processes. Though the production was almost stopped for 3-4 days, management made a decision to stop the existing (legacy) system that was in use as the new ERP system went live. This was done to ensure that project related issues were solved as quickly as possible. With the legacy system still in use, it was possible that project related issues would not be looked into as a priority and this could have lead to a delay in successful implementation of ERP technology in the firm.

The Executive (finance) explained,

> *...So we spent late hours in the office along with the implementation partner, IT Manager and project champion to solve the problems. The problems were related to connectivity with servers, new data, learning and understanding new business operations work flow and in producing desired reports. After the initial two weeks, departments began to run smoothly...We were learning over time to tackle mistakes related to data or entry field mistakes.*

Another implementation factor considered important by case study participants was users' feedback. The end-users' feedback was taken regularly but changes were conducted in the system only if they were considered to be important by the ERP team, as team members were aware of the fact that too many changes in the system leads to extensive customisation of the ERP system. This in turn can affect the project progress.

The Executive (finance) stated,

Whenever we had a problem operating the new process, the IT Manager immediately tried to explain the new system to us. Sometimes, there were some fields missing from the table, for example length of material that has been introduced in the system recently. Then if it was considered important only then changes were made. Otherwise we were told how that information can be put in another field or may be neglected.

6.1.4 Summary

Summary of the key ERP implementation success factors discussed in the above sections is presented in table 6.3. This case clearly demonstrates that management skills and ERP knowledge possessed by top management, IT technical skills possessed by the IT Manager, understanding of benefits of ERP by the end-users, ERP implementation knowledge and prior experience by the ERP Implementation Manager assisted in successful ERP implementation.

Table 6.3 - Summary of factors contributed to successful ERP implementation

Emergence of idea: internal or external	Internal idea: Top management influenced by other firms deriving benefits from ERP system
Reasons for ERP implementation	To shorten production cycle and reduce inventory levels
Top management support	It was always present as the initiation to go for an ERP was from management
Selection of ERP team	Core team members were selected based on knowledge of business processes and IT knowledge
Project planning	Very detailed ERP planning prior to implementation
Vendor selection process	It was a lengthy process and a lot of time was spent on it. BAAN was selected after carrying out comparison of three well-known vendors
Communication	Project progress updated on a regular basis to ERP team members and firm's employees
BPR and customisation	Only few major changes were made in the business processes
Training process	Customised training provided to IT Manager, Head of departments and users
Implementation strategy	Big bang was chosen due to suggestions made by implementation partners
Users' feedback	Received from time to time
Users' resistance	Found to be almost absent

Source - Compiled by the author

The following points can be highlighted in case 1:

a. Top management and the ERP Implementation Manager's commitment and positive approach towards ERP technology. Their involvement in most of the important ERP processes like the vendor selection process, project planning and ERP team members' selection shows their understanding of significant ERP implementation success factors.

b. ERP team members were involved completely in ERP project throughout the project implementation. This shows availability of required human resources during the implementation process.

c. Dedication towards successful implementation among team members, users and employees was created through communicating effectively with them regularly by various means.

d. Sites of customers of implementation partner of the ERP vendors were visited separately by the top management and the ERP team members. Thus they have shared the experiences and knowledge of another firm already in the process of ERP technology implementation.

e. Functional training was given to the users not only relevant to their department but also how ERP system will be linked with other departments' business processes. Thus users were given opportunity to learn how the ERP system would work rather than restricting them to their task. All those undergoing training were asked to practice as even one wrong entry can affect the whole system. Practice sessions were held to ensure training had been absorbed.

f. Users' feedback taken regularly during implementation but changes in ERP solutions were made only when it was necessary. This helped to minimise customisation.

g. Prior ERP implementation failure has helped the firm to learn lessons. The firm had ensured that the same mistakes were not repeated during the second implementation. The firm considered inappropriate vendor selection and extensive customisation as the major reason for the first failed implementation. Therefore, an extensive vendor selection process was carried out during the second implementation and measures were taken to ensure minimum customisation.

6.2 Case study 2

6.2.1 Introduction: firm's background and ERP implementation status

Firm 2 was established in 1992 and manufactures automobile interiors. This firm manufactures four different products with over 50 different models. The product range of auto interior products includes seating systems, rear view mirrors, arm rest assemblies and roof liners. It has a production capacity of 200,000 seating systems/annum. The major customers are car manufacturers like Baleno, Omni, Alto and Wagon R.

This firm is a joint venture company of Suzuki Motor Corporation of Japan and Maruti Udyog limited, India. In firm 2, both top management and the IT department took the initiative to implement ERP in January 2006. The mission of firm 2 is to become world class IT enabled manufacturing firm. Thus, top management was found to be very keen on implementing ERP solutions.

According to the Chairman,

> *Our mission is to become a world class IT enabled manufacturing company, so we are giving lot of emphasis to IT. To become a world class IT enabled company, our goals are defined in such a manner to achieve our mission. We have some specific goals to achieve that particular vision, like benchmarking particular industries for ERP implementations and adopting world class IT solutions and best practices in the world, like ERP.*

The main reason to deploy ERP according to the Chief Information Officer was to enhance the auto interior production process of the firm by coordinating the manufacturing process in a more efficient and effective way.

Right now it is the need of the hour basically and any company, which can adopt ERP, can increase productivity. If the productivity can be increased everything can, every aspect can. You know we are a manufacturing medium size company and we definitely wanted to increase our production. As IT is an integral part of our business right now, we have implemented ERP. If ERP can be implemented in a proper manner, very good manner, then we can gain lot from it.

The Chief Information Officer also noted that total ERP costs and return on investment costs were calculated prior to a final decision to adopt ERP solutions in the firm,

> *...Also, we calculated several other things like total ERP costs, return of investment payback periods and all these things were considered because, if you are going to invest a huge amount on ERP and you are not going to get that much return from that, so that in anyway is not going to help you.*

The Chief Information Officer noted that the ERP implementation process was planned very well and consisted of the following stages:

1. ERP implementation decision in the firm
2. Calculations of approximate ERP investments
3. Suitable vendor selection
4. Planning and formation of ERP in-house team
5. Training
6. Testing and troubleshooting
7. ERP system live

Table 6.4 shows a summary of firm's background and ERP implementation status.

Table 6.4 - Summary of firm's characteristics and ERP system

Year of establishment	1992
Number of employees	200
Annual turnover	2.0 billion INR (approx. 30 million GBP)
Industry	Manufacturing- automobiles interiors
Year of ERP implementation	Jan 2006
Implementation duration	8 months
Estimated ERP cost	80 lakhs INR (approx. 96,000 GBP)
Implementation approach	Big bang
ERP vendor	SAP
Project champion	Chief Information Officer
Project team members	8
Number of end-users	15
ERP modules implemented	Finance, accounts, sales and production planning
Status of ERP modules in the system	Has gone live
Configuration	Completed
Manual or legacy system in use with current ERP	Partly
Business operation after ERP implementation	Smooth
Upgrade to next ERP release	Not planning
Interviewees	Chairman, Chief Information Officer and Executive (accounts)

Source - Compiled by the author

6.2.2 Level of success

The Chairman, the Chief Information Officer and the Executive (accounts) agreed that the ERP system has been a successful implementation. According to the Chairman ERP has been a success because its implementation has led to streamlining and standardisation of the business processes.

According to the Chief Information Officer, ERP can be said to be successfully implemented because the firm have real - time information access across the enterprise that helps in informed and fast decision making.

The Chief Information Officer described some of the other ERP benefits,

> *Earlier we had FoxPro that is just a module based standalone system that was not integrated. But now ERP solutions have given lot of benefits to the organisation. Lot of benefits in the sense, providing the right information at right time for the right persons. It is helping us in decision making through user friendly reports. Through ERP, we are capturing data at the point of generation and duplicity of data is also a lot less. We are happy with functions ERP is giving us.*

ERP implementation success perceived by interviewees is shown in table 6.5.

Table 6.5 - Implementation success indicators

	Full implementation success	Limited implementation success	Implementation failure
Time schedule	Almost within planned time		
Budget utilisation	Almost within planned budget		
Users	Satisfied		
Benefits	Most of the ERP benefits		

Source - Compiled by the author

The next section describes the implementation success factors explained by the Chairman, the Chief Information Officer and the Executive (accounts). The Chief Information Officer acted as a project champion for the ERP project. He has strong IT background with a Masters Degree in Computer applications with prior experience of IT implementation. The

Executive from the accounts department was an end-user and involved in the implementation process during the later stages.

6.2.3 Critical success factors

6.2.3.1 Introduction

In the following sub-sections, the field data on key ERP implementation success factors is presented.

6.2.3.2 Top management support

Top management support was present with the IT department in the implementation process. According to the Chief Information Officer, ERP systems implementation is totally driven by a top management. For implementation to be successful, it should always be a top down approach.

> *...they (top management) were coming for meetings on a regular basis...if any issues came up I always discussed with them, talked with them...I have received full support from them...no interference came from them. For example, when I told them about upgrading some of the computers then they agreed, similarly about selection of modules and ERP core team they were with me.*

In this firm top management provided business leadership and supported the IT staff in all the phases of the ERP implementation. The financial resource was made available by them for a well-known vendor's ERP solution and the extensive ERP training. One of the reasons for their support was a keen interest to adopt IT solutions that can enhance the efficiency of their production process. Top management had good understanding of ERP functionality and its importance to their firm.

6.2.3.3 ERP team

The ERP in-house team consisted of 8 members. ERP team members of this firm were involved in other office duties as well. For them the ERP project was additional work that they took up alongside their normal office job. Team members were selected based on their interest in ERP technology and understanding of the business processes.

The Chief Information Officer stated,

> *Due to non availability of spare staff...our staff were not only involved in ERP but also doing their other staff work as we were not able to dedicate a team for the whole implementation duration.*

6.2.3.4 Project planning

Most of the details of the ERP project were considered during the planning phase. According to both top management and the Chief Information Officer, project planning is one of the important elements to complete ERP within the scheduled time frame. ERP is a time consuming, complex process and involves various project activities therefore scheduling of project tasks needs to be done beforehand. The main emphasis was on better resource planning and risk management analysis.

The Chief Information Officer observed,

> *...In our company, management also helped in planning. They were especially involved in calculating total costs of the ERP project. We looked at each step of the implementation process, activities in those steps and approximate time required for those activities.*

The Chairman of this firm was familiar with project planning techniques and had strong belief that project planning had to be followed to finish ERP solutions

implementation within the scheduled time frame. He stressed a lack of knowledge by SMEs on good project management techniques as one of the major reasons for ERP implementation failure.

> *Adopting any particular solution by any organisation can be done through a better evaluation process, but for implementing solutions we have to follow a standard implementation methodology like better project management techniques, scheduling of tasks and communication plans and all these things...so this is the area where SMEs are lacking because most of them don't have that much knowledge on the standard or the good project management technique. This is the major reason for the increase in failures of ERP solutions...if you adopt very good project planning techniques in implementation it will definitely give you a return.*

6.2.3.5 Vendor selection process

Case study participants stated the vendor selection process was considered important for ERP success. Both the Chief Information Officer and management worked together to identify an ERP vendor with an ERP solution that would best suit the company's business practices. The Chief Information Officer explained the process of vendor selection was mainly based on its compatibility with the firm's business processes rather than following other firms' recommendations about vendors.

> *...So instead of blindly following somebody for implementing solutions, we first considered our requirements and looked if that particular solution was going to suit our business process...To analyse our requirements basically, in the sense current requirements as well as future requirements for expansion of the company...So we selected SAP and implemented their particular solutions as per our requirements (Chief Information Officer).*

6.2.3.6 Communication

Interviewees noted that effective communication has been maintained throughout the project implementation. Management and staff were updated on ERP project progress on a regular basis. There was very good communication with the solution providers and management. Management received updates from them regularly and the in-house ERP team attended seminars provided by the SAP implementation team.

The Chief Information Officer said,

> *...Basically communication was on going as their (implementation partner) team was stationed here for six months... It was primarily the responsibility of the IT department to update management as well as the other staff in this company about the ERP technology and new developments.*

6.2.3.7 Business process re-engineering and customisation

Both the Chief Information Officer and the Executive (accounts) stated that the chosen ERP solution was already aligned with the firm's existing processes. Hence, only some changes were made in the existing business processes. The Chief Information Officer stated that he had knowledge of BPR and knew its importance for ERP to be completed within the planned time. Firm 2 spent time in selecting an appropriate ERP solution mainly to avoid ERP customisation. An effort was made in the firm to avoid customisation of the ERP software in order not to increase the implementation costs and time.

The Chief Information Officer explained the use of ERP templates by some of the vendors these days as they can save implementation time. However, in this firm templates were not used and SAP configured the ERP software according to the company's requirement.

The Chief Information Officer explained how the templates can prove to be time saving,

Though we did not use them, these days lots of ERP vendors are now providing templates. Templates mean if some companies like ours for example say JCN, they are also in the same type of business as us, same kind of automobile interior manufacturing and they are also supplying to Maruti. So if they are also going for SAP implementation, they can copy the same thing that we implemented here, because the process are same, the customer is same, the major things are the same, the statutory requirements are the same, we are on the same region also, so vendors can copy the template to them and then do a little bit of modification as per their requirements. If your company is following some complicated process then the solution provider has to do lot of modifications to the standard system that may take time. Otherwise if you are adopting the standard template then it will take less time. This way the speed of the implementation process can be increased.

6.2.3.8 Training process

In firm 2 extensive training was undertaken by the project champion, key users from all departments and personnel from the IT department. Training duration varied from one week to four weeks depending on the requirements and skills of the staff. It was provided by the implementation partner team who was stationed at the company's location. The training was given to end-users on how to use the new system about two months before the ERP system went live. It was ensured that the training helped end-users to change their mindsets and adapt to the new ERP system.

The Chief Information Officer stated,

Training was also part of the implementation process and we put a lot of emphasis on it. Right now we are also putting a lot of emphasis on training with any new developments we are doing. So we make training part of that particular development. Mind change is one of the areas where, you know what happens with

old employees of the company, that people who used a particular solution for very long time and telling them to change to a new ERP solutions, the adaptability to that particular solution is a difficult task. We did lot of training, we did lot of counseling type of things to change their mindsets regarding ERP.

The Executive (accounts) also stated that training was started before the system went live.

First we were trained about the general ERP system giving an overall view and then about the functions that users from different departments had to do on the new system. Some users resisted initially but then later on they agreed.

6.2.3.9 Other key success factors

According to the case study participants, users' involvement and their feedback was considered as one of the implementation success factors. Because the implementation team was aware that users' involvement would assist in acceptance of the new system.

The Executive (accounts) confirmed,

Feedback was always taken regularly...Users required some user friendly things to be done and they need something to reduce their work and they needed a solution or system on which they could depend on to get more accurate data. So they welcomed ERP system when they understood the importance of the ERP system.

6.2.4 Summary

Table 6.6 shows a summary of the factors related to the successful ERP implementation.

Table 6.6 - Summary of factors related to successful ERP implementation

Emergence of idea: internal or external	Internal: management and IT department
Reasons for ERP implementation	To enhance production process
Top management	Supported throughout the implementation
ERP team selection	Team was chosen based on IT knowledge and business processes
Project planning	Detailed project planning
Vendor selection	Based on company's requirements and business processes
Communication	ERP project progress effectively communicated to ERP team members and employees of the firm
BPR and customisation	Business practices were modified to ERP configuration rather than customisation
Training process	Based on trainees' skills and job requirements
Implementation strategy	Big bang
Users' feedback	Received
Users' resistance	Initially observed but later users accepted ERP

Source - Compiled by the author

The following points can be highlighted in this case:

a. Top level strategic support - keenness of the Chairman to implement ERP technology to become a world class IT enabled manufacturing company.

b. Clear understanding of how firm can gain performance advantage from ERP technology.

c. Case study participants indicated ERP has been implemented successfully in the firm because the benefits observed after ERP implementation. For example, standardised business practices of the firm, faster decision making, capturing of data at the point of generation are some of the gains the company has achieved from its ERP implementation.

d. The Chief Information Officer possessed good knowledge of project planning techniques and understood its importance especially for SMEs. Project planning

included resource planning, time schedule for ERP project activities, scheduling of tasks and communication plans.

e. The ERP solution was selected based on the study of firm's current business processes. However, the firm's future growth and total ERP costs were also considered when making the decision on the ERP vendor.

f. Top management and Chief Information Officer have prior knowledge on how customisation of ERP software could lead to increased implementation costs and time. Thus, ERP solution was restricted to the configuration and SAP was preferred so that an ERP solution could be chosen that suited the firm's business processes.

g. Training strategies were developed based on the requirements and existing skills of the ERP team members. Training was also considered as a medium for changing the mindset of users and to increase their adaptability to the new ERP system.

6.3 Case study 3

6.3.1 Introduction: firm's background and ERP implementation status

Firm 3 is a manufacturer of steering gears in India, established in 1985. It employs about 150 personnel and has a turnover of about 2.5 billion INR (approx. 37.5 million GBP). The manufacturing plant is in Gurgaon (state Haryana), India. The product range includes hydraulic power steering systems, manual rack steering systems and rigid steering systems for passenger vans. This firm has adopted a Total Productive Maintenance (TPM) technique to improve performance through the philosophy of prevention. It aims to achieve zero accidents, zero defects and zero breakdowns.

Chairman and Managing Director initiated the process of ERP implementation in January 2002. Although, he was reluctant in the beginning to implement ERP because of a lot of doubts raised about ERP, he found the solutions to those questions through discussion with major ERP vendors and sharing experiences of other firms. Later on the decision to implement ERP was made in consultation with the Head of IT.

The Chairman and Managing Director explained,

> *Initially, resistance came from myself. When I looked at other success stories they were from Ford, General Motors, all big companies. It made me to think why shall I invest in it? We were using an in-house customised Oracle based software system. The question in my mind was shall we go for it? Is it going to be worth investing? I had then a chat with Oracle. I asked them why you keep selling the fact big companies are using it. I want to know about companies using ERP of our size. Oracle told me some small size companies using ERP. I happened to be a board member of one company of our size. They were in the process of implementation. I spoke to their IT Manager. He told me the real story- it is wonderful, it will*

structure your processes. He made me understand the benefits that ERP can give even to small firms. Then I spoke to our IT department and we started looking at the offerings we had. Our IT department had lot of excitement but other departments had many questions like what is the need and similar types of questions.

Table 6.7 shows a summary of the firm's background and ERP system.

Table 6.7 - Summary of firm's characteristics and ERP system

Year of establishment	1985
Number of employees	150
Annual turnover	2.5 billion INR (approx. 37.5 million GBP)
Industry	Manufacturing-steering systems
Year of ERP implementation	January 2002
Implementation duration	10 months
Estimated ERP cost	60 lakhs INR (approx. 72,000 GBP)
Implementation strategy	Big bang
ERP vendor	Oracle
Project champion	Head of IT
Project team members	8
Number of end-users	15
ERP modules implemented	Financials, manufacturing, purchasing, sales analyser and order management
Status of ERP modules in the system	Implementation completed
Configuration	Completed
Manual or legacy system in use with current ERP	Not in use for most of the business functions
Operation of business after ERP	Efficiency gained
Upgrade to next ERP release	Planning
Interviewees	Chairman and Managing Director and Head of IT

Source - Compiled by the author

According to the Head of IT, ERP implementation went through the following steps:

1. Sharing information and knowledge on ERP implementation with other firms by top management
2. Decision on ERP implementation in consultation with the Head of IT
3. Vendor selection process
4. Scheduling of project tasks
5. In-house ERP team formation
6. Training for ERP team members
7. Testing and users feedback of pilot project
8. ERP live

6.3.2 Level of success

Both case study participants agreed the ERP system has been a success in the firm based on the benefits realised. ERP implementation has given significant return on investment, information flow has become seamless, real time information is available and business processes have been standardised.

According to the Chairman and Managing Director, it has been a success because,

a. I get balance sheet ready within a week of quarter ending

b. Book stocks and physical stocks are fairly close to each other

c. I do not hear customers complaining about invoices and suppliers complaining about payments

d. Inventories are maintained as we planned them to be

e. Annual accounts ready by few days of year closing

ERP implementation success perceived by interviewees is shown in table 6.8.

Table 6.8 - Implementation success indicators

	Full implementation success	Limited implementation success	Implementation failure
Time schedule	Completed almost within time		
Budget	Almost within planned budget		
Users	Satisfied		
Benefits	Gained		

Source - Compiled by the author

The next section describes the implementation success factors explained by the Chairman and Managing Director who initiated the ERP process and the Head of IT who acted as a project champion for the ERP project. The Chairman and Managing Director possessed a Business Management Degree and the Head of IT had a Masters Degree in IT.

6.3.3 Critical success factors

6.3.3.1 Introduction

In the following sub-sections, the field data on key ERP implementation success factors is presented.

6.3.3.2 Top management support

The Head of IT indicated top management was engaged in most of the ERP project related activities throughout the project. For instance they were involved in planning project deadlines, choosing the vendor, building up a team and communicating with other departments about ERP benefits. Their main concern was to complete the implementation on schedule so that the firm could begin to realise the benefits from the ERP technology.

The Head of IT spoke of top management support during the implementation process,

Our Chairman always supported us during the implementation as he himself was keen to complete the implementation process on time...he himself told people in the company how ERP could help in streamlining the business processes and reduce work and increase output of what they were doing. I think we have always got support from our management. I can say they were interested in implementation and wanted to get benefits of ERP.

The Chairman and Managing Director also stated that he was present in most of the weekly meetings to discuss the progress of the project. According to him top management support is a must and has to be there to make ERP successful. Otherwise employees may not show interest and this may lead to ERP implementation failure. He emphasised the need for team effort and stated that management involvement encouraged team working. Also top management provided leadership, project direction and helped in solving ERP project related problems.

Yes most of the time I was present in the meetings to discuss the project progress in general and any issues in particular... Without our support it is difficult for the IT Department to do by themselves. It is something where everyone has to be involved.

6.3.3.3 ERP team members

The Head of IT and Chairman and Managing Director both noted that the in-house cross-functional ERP team was named the 'Dream Team' and it worked only on the ERP implementation until the implementation was complete. In addition to the in-house team, a steering committee was established to provide leadership and make key decisions.

According to the Chairman and Managing Director,

We created a full time working team and it worked for us. One person was volunteered from each department for the ERP team. It was more of a cross-

functional team rather than IT team. A steering committee was there to oversee any hiccups. By and large it has been successful because we had dedicated people.

The Head of IT stated that the in-house team members were involved in giving and receiving inputs from other departments and worked some days out of office hours. It was partly because of instructions from the Chairman and Managing Director that members of the team had to be committed to the project and, if needed, had to spend late evenings in the office.

The Chairman and Managing Director explained the importance of a dedicated ERP implementation team,

Team members play an important role. A fully dedicated and full time team is a must. Nothing less than that... ERP system is a breakthrough because ERP is a new project. To establish something new which is not existing in the organisation it requires a different kind of approach altogether. It is not introducing a new product of the type you already make. Therefore, we made an ERP team only for the ERP project... Regarding an implementation partner, we had the same team throughout and I think it is a vital factor for making implementation a success. I have seen, due to a shortage of ERP experts in India, team members from the implementation partner team keep changing but in our case I must say we were lucky.

Though the firm has not faced issues of trained ERP members leaving the firm, the Chairman and Managing Director mentioned it is difficult to retain trained ERP personnel in the firms especially in SMEs, because it is easier for personnel in SMEs to move larger organisations.

...part of the problem that comes with ERP is once people are trained in ERP they have high market value and they leave. As a result you have nobody and then you have

to start again to look for a replacement. During implementation we did faced this problem but later on sustaining ERP experts is a major concern that I think most organisations face (Chairman and Managing Director).

6.3.3.4 Project planning

The Chairman and Managing Director indicated that in co-ordination with the implementation partner's (vendor's) team, extensive project planning was conducted. Project tasks were planned to be completed in certain time frames, work was allotted to team members, and some key meetings were also planned. Time frames for training programs and study of business processes were planned at a particularly detailed level.

The Chairman and Managing Director expressed his views on the project planning,

Because without project planning how can you move?...Our implementation partner guided us about planning as we were not too sure how much time project activities would take to complete. We had steering committee meetings each week at the start of the project. When progress was reasonable, meetings were conducted every two weeks. Towards the end of implementation, we had one meeting per week to solve any issues immediately. So all these things were planned and followed in our company.

Although emphasis was placed on detailed planning of most of the issues that were expected to arise during implementation, the firm faced a challenge of localisation of software for which firm had not made any contingency plans.

The Chairman and Managing Director reported,

A big challenge was localisation of software. As you know every state in India has a different tax system, customers we sell to have different tax systems, excise duties

are different, lot of different acts in different parts of India...all this led to invoicing problems. So these things take time and in our case it took more time than initially planned.

The Head of IT described how ERP implementation was considered as a major business project, therefore project planning techniques were considered necessary to accomplish successful ERP.

Some of the project planning was described by the Head of IT,

During project planning along with our implementation partner we looked at the availability and requirements for resources like people, finance, time, and infrastructure and planned accordingly. Then weekly and monthly charts were drawn up about work progress and team members were made responsible for project tasks.

Back up plans were made for commonly occurring issues like,

Our implementation partner told us some common problems based on their experiences that come up like people leaving the organisation, the system not functioning properly during software installation, not receiving timely information from other departments etc so we thought of back up plans in case we need them (Head of IT).

6.3.3.5 Vendor selection process

The Head of IT described the vendor selection process. A comparison between ERP solutions provided by market leaders like SAP, BAAN and Oracle was carried out to understand investment costs, implementation duration and suitability of ERP solution with

the firm's processes. Most of the preliminary information was collected by management and IT team through seminars.

The Head of IT explained the reasons for selecting ERP solution by Oracle,

> *...I attended a lot of seminars by software companies like SAP, BAAN...Oracle. We went for Oracle as they have implemented in more companies of our size. We already had an Oracle based in-house solution and other Oracle applications can be integrated with their ERP. These were some of the reasons why the decision went in favour of Oracle. Another reason was the implementation partners of Oracle were more willing to work for us rather than SAP. SAP did not seem to be interested to sell to us. Probably they thought they were too good.*

However, the Chairman and Managing Director explained that the vendor selection process is not very easy,

> *Vendor selection is very difficult as you are dealing with a black box. They will tell you about all the reports that come out. There is no science basis. It is a just gut feeling. Lots of hype and promises are given but there are problems they are not sorted out by just power point presentations in a boardroom. You have to see the nitty gritty in the shop floor.*

6.3.3.6 Communication

The case study participants described how interaction among ERP team members was maintained through different means of communication.

The Head of IT expressed effective communication was important to keep team members motivated.

We had a different environment when implementation was going on. We all knew about the project and who was involved in it. So if there was any problem, we knew whom to contact. E-mail was also used to communicate sometimes with the implementation team (Head of IT).

According to the Chairman and Managing Director also, effective communication was considered to be crucial during the implementation process. He said,

Effective communication is a backbone of management...We considered it very important...efforts were made to keep people updated on project development through emails, notice boards, weekly and monthly newsletters and meetings to communicate about project activities.

6.3.3.7 Business process re-engineering and customisation

The Head of IT confirmed that based on Oracle's best business practices model, only a few changes were made to the firm's own business processes. Although, the firm did not want to change their own business functioning, but at the same time they did want to adopt some of the best practices provided by Oracle's ERP solution.

The Head of IT said,

...We looked at Oracle ERP processes and how are they different from ours and what are the difficulties in making changes according to Oracle. We did not really want to make too many changes in the business processes, but we made a few changes as Oracle have best business practices in the world and we did not want to change that either. So we tried to balance both.

The Head of IT described how customisation has been kept to a minimum because customisation leads to a more complexity in the project. Case study participants agreed that

modification of the ERP system code can lead to delays in the project and increases in project costs.

Further, according to the Head of IT,

> *The Oracle ERP system is based on best business practices in the world and if we make many changes then it would be more of a customised ERP software rather than an Oracle ERP system. So we kept the modifications to very few... another difficulty faced by organisations that do lot of changes is when upgrading of the system is needed in the future. I have seen organisations unable to complete future upgrades successfully. So I mean we preferred to stick to the Oracle ERP system.*

6.3.3.8 Training process

Training was provided to all the team members including the project champion. Both functional and technical training was given and the level of training varied according to the team members' existing skills and knowledge.

The Head of IT explained training was considered crucial for implementation success and it was conducted in two phases rather than one-off training. Online support was available 24 hours a day from the implementation partner.

> *Training on the overall concept of ERP was given in the beginning to all ERP team members and users. Later on, after few weeks customised training was given. The focus this time was to train people in their respective related ERP modules. IT people were trained for common problems that might come up during implementation and post-implementation. Their training was more on the technical side than functional.*

According to the Chairman and Managing Director the aim of training was to have at least one proficient person in each department with knowledge of the ERP system, so they can train others in the future. Other organisations were visited by ERP team members to understand how ERP systems work in addition to the in-house training. This provided an opportunity for team members to learn from other firms' experiences and share information.

> *We trained a few people from each department, visited other organisations to see how they work on their ERP system. Induction for new employees and retraining for current employees has been organised...the aim was each department should have one person called a project champion who would have functional knowledge (Chairman and Managing Director).*

6.3.4 Summary

The following features can be highlighted in this case:

a. Top management took an interest in ERP technology and attempted to find the answers to some of the important ERP related questions for instance about ERP process, investment costs and the performance advantage that can be gained from ERP technology. The top management made a decision to implement ERP based on their requirement for streamlining the business.
b. Top management was involved in most of the crucial project activities like forming the ERP team, vendor selection process, attending regular meetings and communicating with staff regularly.
c. ERP implementation was considered as a new project so a dedicated team for the ERP project was formed. Efforts were made that no changes were made to this team throughout the implementation period. It was a cross-functional team with good understanding of business practices.

d. Vendor selection process was carried out extensively. For example, seminars presented by the different ERP vendors were attended by the ERP team and other firms' ERP implementation experiences were shared.

e. Communication among team members and staff was considered very important and project progress was updated on a regular basis through emails, notice boards, newsletters, formal and informal meetings.

f. Training was conducted in two parts. The first part consisted of training on overall concept of ERP and the second part consisted of customised training.

A summary of the key ERP implementation success factors is presented in table 6.9.

Table 6.9 - Summary of factors related to successful ERP implementation

Emergence of idea: internal or external	Internal: Chairman and Managing Director after learning of experiences of ERP benefits from other firms
Reasons for ERP implementation	Streamlining business processes
Top management support	Always present as adoption was driven by management
ERP team	It was a cross-functional team
Project planning	Detailed level planning undertaken
Vendor selection process	Chairman and Managing Director selected vendor mainly because Oracle was running successfully in the same size of companies
Communication	Effective communication maintained throughout the project
BPR and customisation	Few changes made to business practices to fit Oracle ERP system
Training process	Formal training
Implementation strategy	Big bang
Users' feedback	Taken regularly
Users' resistance	Not seen

Source - Compiled by the author

6.4 Case study 4

6.4.1 Introduction: firm's background and ERP implementation status

Firm 4 is the Indian subsidiary of an International firm. It was established in 1997 and manufactures homoeopathic and phytopharmaceutical products. The manufacturing plant is located at Noida (in State Uttar Pradesh), India. Manufacturing started with Biocombinations and today the product range has been extended to a wide range of speciality formulations for day to day common ailments and topical creams and gels. The firm has about 300 employees and an annual turnover of about 4.0 billion INR (around 60 million GBP).

ERP was initiated in the firm in 2001. The idea came from the parent company in Germany. The IT Manager explained the main reason to adopt ERP was to establish a centralised database system,

> *See, this is a German company. So, Germans very much believe in systems...If you don't have any systems, you can't run your organisation well...So, keeping track of the entire department activities in terms of order flow, in terms of finances, and everything, you have to establish one system. The system can generate and prompt reports and you can analyse the data in that report...*

According to the IT Manager, most of the firms go through the same steps while implementing ERP. However, the time spent on each step and importance given to each phase varies from firm to firm and that determines ERP success or failure. The process of implementation in the company as described by the IT Manager was:

1. Selection of vendor
2. Define the process
3. Gap analysis-most important-study of own business and what ERP has to offer

4. System requirement study (SRS)
5. Pilot testing
6. Implementation/live testing
7. Post-implementation

Table 6.10 shows a summary of the firm's background and ERP implementation status.

Table 6.10 - Summary of firm's characteristics and ERP system

Year of establishment	1997
Number of employees	300
Annual turnover	4.0 billion INR (approx. 60 million GBP)
Industry	Manufacturing- medicines
Year of ERP implementation	2001
Implementation duration	9 months
Estimated ERP cost	75 lakhs (approx. 90,000 GBP)
Implementation approach	Big bang
ERP vendor	Movex
Project champion	IT Manager
Project team members	20
Number of end-users	35
ERP modules implemented	Accounts, finance, sales, purchase and production
Status of ERP modules in the system	Implementation complete
Configuration	Completed
Manual or legacy system in use with current ERP	No
Operation of business after ERP implementation	Smooth
Upgrade to current ERP release	Yes
Interviewees	General Manager, IT Manager and Executive (finance)

Source - Compiled by the author

6.4.2 Level of success

The IT Manager and Executive (finance) both agreed that the ERP system implementation has been a success in the company. According to the IT Manager, it is a success because users' satisfaction is high, management is getting the desired reports and automation of the business has been increased. Table 6.11 illustrates level of success in firm 4.

The IT Manager gave the following example,

> *...our General Manager can see anything and any report any time because all the data is integrated in this...we are using all modules with full options. No manual system is in use so you can just imagine we are totally reliant on the ERP. Recently we have made a interface in which an electronic order from customers gets into the ERP system within 5 minutes with one click of a button. Earlier it was taking one day to put an order into the system. Now each and every step of our business moves and is through the ERP...It is all automatic.*

The IT Manager gave a further example to illustrate how ERP is helping the business,

> *...So, it means each and every step, you know what is the status of anything about your payment, about your material, about your dispatch...as any order comes it enters into the ERP as an order and this order goes to production to see the availability of material. And, if the material is available, then it will go for listing and generating invoices and everything. If the material is not available, then we have to go to purchasing. When the purchase is done, then it will go to the manufacturing unit and thus from manufacturing it goes to the warehouse to dispatch. So, this is the whole process which we are keeping track on with this.*

The Executive (finance) said the company is progressing well after ERP implementation. ERP is providing output in the form of reports to management and many other benefits,

In the pharmaceutical industry, tracking of the entry is very important, suppose a batch number of medicine needs to be tracked then information on all the raw materials can be traced, how it was manufactured, how was it purchased etc...so ERP can give us this type of output.

Table 6.11 - Implementation success indicators

	Full implementation success	Limited implementation success	Implementation failure
Time schedule	Completed almost within schedule		
Budget	Within planned budget		
Users' satisfaction	High		
Benefits	Gained		

Source - Compiled by the author

The next section describes the implementation success factors explained by the case study participants. The IT Manager acted as a project champion for the ERP project. He has a Masters Degree in IT and has done a part time business management course. The Executive (finance) was a core team member and involved in the implementation process.

6.4.3 Critical success factors

6.4.3.1 Introduction

In the following sub-sections, the field data on key ERP implementation success factors is presented.

6.4.3.2 Top management support

Both the case study participants stated that for ERP success in any firm, top management is the critical success factor. According to the IT Manager, top management support is

required throughout the project. They have to be dedicated and have to take time out from their schedule if they want to make ERP implementation successful.

According to the IT Manager they had full support from the top management,

> *They frequently came to progress meetings with users, core team members and implementation partners. ERP is a big project. It is not like building a house or factory where one construction engineer or Project Manager is in charge...in our company management has taken ERP as their baby and they handled it well...that is why we have been successful...*

The Executive (finance) indicated that top management has forced and pushed the users to work on the ERP system.

> *Without management intervention nothing moves...users are not ready to work on the ERP system though they know it is beneficial for them...management has forced and pushed the users and in that way involvement from top management was with us...other than this they guided how to move, what to do, spoke to vendors, gave resources that we wanted.*

6.4.3.3 ERP team members

According to the IT Manager, the best personnel from the organisation were selected for the core team based on their interest in learning new technology and self motivation. A cross-functional team was formed to ensure full understanding of business.

The IT Manager stated,

> *We wanted best people in our team with very good business knowledge...the main criteria for selecting the team were: interest in learning new technology and self*

motivated...these were the people who had the responsibilities so all heads of departments were asked to help in selecting a cross-functional team.

6.4.3.4 Project planning

In this firm, detailed project planning was a combined effort of the implementation partner and the core ERP team members.

The IT Manager expressed the importance of project planning,

Not making a plan is like moving without any direction. The process was well planned and defined at the start how we are going to do things, what we are going to do, who is going to do what...all planning was done both by our external implementers and our own team. And I said earlier, top management came to progress meetings to see if progress was according to plan or not.

However, the Executive (finance) stated that though planning was completed well before the implementation commenced certain issues like government laws, excise duty for domestic and imported products, because they are different for every state, required attention during implementation.

...Planning is important but when we plan we think everything will go well but when you implement problems occur frequently and they sometimes take time...we studied our processes in-depth and that took longer than planned.

6.4.3.5 Vendor selection process

According to the IT Manager suitable vendor selection is the second most important factor in making ERP a success. There are many consultants available in India who study firm's requirements and how the business functions and then suggest an appropriate ERP

solution. Hiring consultants is expensive especially for SMEs. So, not all companies can hire external consultants.

> *...That again depends. If you are taking an international brand like SAP it is costly. It will cost you millions. If you are looking at a local brand, it can cost you in lakhs. So, that again depends upon the industry and the size of your company. What is the budget? It is same for everyone but the thing is that SAP is very costly and it is usually for large organisations (IT Manager).*

The IT Manager further explained as each industry has different business processes, so the vendor's understanding of the firm's and industry processes is very important. The vendor's knowledge of implementation in the pharmaceutical industry was one of the criteria for the selection of the vendor.

The IT Manager said,

> *We knew there was a 100 per cent chance of having a failed ERP if the wrong selection of a vendor was made...so we spent one month on it. We selected Movex because of certain reasons - how many successful implementations and years of experience they had in the pharmaceutical industry, their success rate, their rating, how much time they would take, how much customisation they would require- these were the main things that we considered.*

6.4.3.6 Communication

Case study participants noted they did not adopt any formal means to communicate about project progress. However, regular meetings and frequent informal meetings were held among team members to discuss project progress and project related issues.

6.4.3.7 Business process re-engineering and customisation

The case study participants stated that only a few necessary changes were made in the business to fit the ERP system and to avoid the customisation.

The IT Manager described this,

> *We made few changes because we have to follow the ERP system. The ERP system cannot follow us. Our vendor has options of different processes so we selected what was close to our business...we did not want to go for any customisation because when you start making changes, they never finish...we changed a few processes to fit with the ERP system*

The IT Manager stressed that once customisation is started, it is a never ending process. So they followed the ERP system rather than going for customisation. He said that is why big vendors do not customise, for example,

> *...SAP only configure because they have international features. So, whichever suits you they will configure according to your need. So you configure it and you run it. But the thing is every ERP has its limitations and so you cannot say that if you are having the SAP then you will have everything...Maybe the reporting part you have to generate some other type of reports which SAP do not support. So you have to have some other tools to get data from SAP and you can run your reports.*

Local vendors have to customise the ERP systems as it is difficult for them to provide customers with a wide range of different options as this would be too expensive for them.

According to the IT Manager, staffs in most companies are not aware of how customisation can make their implementation difficult,

Local vendors will tell you good things about customisation...and in companies where the IT Manager or top management does not have enough knowledge they will say OK to them and they will start implementing. Then they will know the impact of customisation on implementation...therefore people have to know what is customisation before going for it.

6.4.3.8 Training process

According to the IT Manager, training was given a priority by management and heavy investment was done by top management. Workshops were conducted to teach basic computing before giving ERP training to some staff. Then, technical training was given to the IT personnel. Users training continued for three months.

The IT Manager describe the training,

Yeah, initially we faced some problem because it was a very new setup here. In 2001, you know, people were not well educated at that time. Not computer savvy you can say...So, we did a workshop to train the personnel in basic computers. The implementation team came from Bombay to implement here. They were here for several months. They trained the core team members and me. I can remember, we all got different training depending on how we are going to get involved with ERP...our knowledge and basically what we will do on the system...

The Executive (finance) illustrated how training has helped,

...training helped a lot to get the correct output...for example, suppose in filling in a customer order there are different parameters like domestic and imported items. If the wrong selection is made by mistake then everything following it will be wrong...wrong invoice...so training to users helps in getting correct output from the system.

6.4.3.9 Other key success factors

Users' feedback and their involvement were considered important to make the ERP system user friendly. This in turn has influence on the ERP implementation success.

A positive attitude was achieved at the later stages of implementation because the users learnt that if they want to be progressive they have to change their mindsets.

According to the IT Manager,

> *...so users had to change...we were taking feedback regularly but not always making changes as suggested by users because we could not do it...touching one module effects another and it is a chain process so we tried to explain this to them and convince them...*

6.4.4 Summary

This case highlights the following characteristics of this firm's ERP implementation:

a. All the modules implemented successfully and are fully in use.
b. Team effort was emphasised and top management were also considered as important team members. Top management involvement was mainly to increase the acceptance of ERP in the firm.
c. The best personnel in the organisation were selected for the cross-functional ERP team based on their interest in ERP technology and self motivation.
d. A few changes were made in the business to follow the ERP system rather than making the ERP system to fit the business processes of the company. The IT Manager had a good understanding how over customisation of the ERP application can adversely affect project progress.

e. During interviews both participants indicated that the company has moved in steps and each step was given importance. Time was spent on vendor selection, system study, training, testing and a pilot study.

Key implementation success factors are summarised in table 6.12.

Table 6.12 - Summary of factors related to successful ERP implementation

Emergence of idea: internal or external	External: From the parent company in Germany
Reasons for ERP implementation	To have a centralised database
Top management support	Full support given
ERP team	Selected on their interest in ERP and self motivation
Project planning	Detailed project planning
Vendor selection process	Based on vendors' experience in the Pharmaceutical industry
Communication	Effective communication through regular meetings
BPR and customisation	Changes in the business processes to minimise customisation
Training process	Formal training
Implementation strategy	Big bang
Users' feedback	Received regularly
Users' resistance	Initially observed

Source - Compiled by the author

6.5 Case study 5

6.5.1 Introduction: firm's background and ERP implementation status

Firm 5 is a manufacturer and retailer of branded garments. It was established in 1992. The enterprise has 125 employees and around 1.0 billion INR (about 15 million GBP) turnover. The manufacturing unit is in Gurgaon (in State Haryana), India and a warehouse facility in Brijwasan (in Delhi), India.

One of the primary drivers for the ERP project initiation in 2000 was to standardise business operations and control inventory through a centralised database.

The reasons for initiating ERP in this firm were described by the IT Manager,

> *Earlier we were using our legacy system, which was built in FoxPro. In FoxPro you don't have any security features, so gradually you need to have all kinds of security features. We are in a business where a shelf life of a product is very, very small, in the sense after every six months we change our entire range and we introduce a new range. That is the maximum, the minimum could be three months or two months. So if we are unable to sell that product in six months time that means that is a dead inventory for us. Either you can sell it in a seconds outlet or you can scrap it but you cannot sell it, as dead garment can hurt our brand image. So the idea of getting the ERP in place was to get the inventory replenishment very fast. Such inventory is either in the warehouse or in a particular shop or in any other location, so that if the demand is there at another location, we can always take the inventory from that location and switch it to another location. So being a centralised warehousing database, controlling inventory has become very easy for us. So this was the point which we kept in our mind when implementing ERP.*

Some of the other reasons were to have linkages among various modules running in the factory, warehouses and head office to allow access to real time information across the enterprise.

The IT Manager described this,

> *Another thing is the integration of all the small scale modules, which were running in the factory or warehouses or head office. We managed to link all the modules together and now there is online posting of sales data or purchase data, this kind of thing.*
>
> *Another thing is the MIS (management information system), which is a real time MIS, which can be generated at any point in time since it is a real time application, so at any given point, we can have inventory or any kind of MIS, balance sheet or any kind of controlling goods.*

The Manager-Systems indicated that an attempt was made to follow a project planning approach for the ERP project and emphasis was placed on detailed project planning. He summarised the following steps for the ERP implementation:

1. Decision on ERP by top management
2. Vendor selection
3. Selection of team
4. Project planning
5. Deep study of business processes
6. Training
7. Changes and installation of software, hardware and data
8. Testing
9. System live

A summary of the firm's characteristics and ERP implementation status is presented in table 6.13.

Table 6.13 - Summary of firm's characteristics and ERP system

Year of establishment	1992
Number of employees	125
Annual turnover	1.0 billion INR (approx. 15 million GBP)
Industry	Manufacturing-clothing
Year of ERP implementation	2000
Implementation duration	About 15 months
Estimated ERP cost	40 lakhs INR (approx. 48,000 GBP)
Implementation approach	Step-by-step
ERP vendor	MFG/Pro
Project champion	IT Manager
Project team members	8
Number of end-users	15
ERP modules implemented	Finance, sales and material management
Status of ERP modules in the system	Implementation completed
Manual or legacy system in use with current ERP	Only ERP is in use
Operation of business	Smooth
Upgrade to next ERP release	No
Interviewees	Manager -systems, IT Manager and Executive-IT

Source - Compiled by the author

The IT Manager indicated the selection of implementation strategy is crucial and explained they preferred to adopt a step-by-step implementation strategy. A sales and distribution module was implemented to begin with. Once it was running successfully only then did the firm move on to the manufacturing module. Step-by-step implementation was chosen to ensure that other departments are not affected if the implementation was unsuccessful in

one department. The case study participants also said that a big bang strategy requires resources like dedicated team members and significant implementation costs to be available from the outset. On the other hand, in the step-by-step implementation strategy, modules could be implemented according to the availability of resources. However, step-by-step implementation can take a long time especially when different modules are required to be linked together through interfaces.

The step-by-step approach was described by the IT Manager,

> *It took us approximately six months to rollout the first phase of our ERP, which was for sales and distribution. It took another six weeks to smooth everything as far as sales and distribution was concerned finally completing the sales and distribution module. We then moved on to a factory manufacturing unit.*
>
> *In the manufacturing module, we had a few problems like, in the garment industry you have masters in matrix form, I hope you understand. You have one style but you have multiple colors and you have multiple sizes and there are very few standard software packages available in the market, which can catalog this kind of matrix. In fact Imaging Pro also had the same problem, so somehow we made an interface and we started implementing the manufacturing module also, but still we had lots of problems. Finally we got a result in the form of this is an order, this is your inventory level, this is your order in process, I mean there are a number of things, which are related. Then we came to financials last, so that is how we implemented. Now it is more of integrated software, which has a financial module, which has a manufacturing module, which has a sales and distribution module and certain more modules are also there.*

6.5.2 Level of ERP success

Though the project has been delayed by few months, it is considered a success by the IT Manager and the Manager-Systems because the firm has gained performance advantage after completion of the ERP system. ERP implementation success indicators are indicated in table 6.14.

Table 6.14 - Implementation success indicators

	Full implementation success	Limited implementation success	Implementation failure
Time schedule		Delayed by few months	
Budget		Over budget	
Users	Satisfied		
Benefits gained	Most of ERP benefits gained		

Source - Compiled by the author

The Manager-Systems explained ERP implementation is a success because a number of benefits have been realised by the firm from the ERP technology,

> *...ERP has helped in numerous ways. It has reduced our rejection levels, we have a centralised database which is again helping us in number of ways...like we have transparent business practices now, getting customised reports that are generated at the end of each day that are again helping us make timely and quick business decisions. So I think these are the things that we wanted to happen and it has happen after the ERP project so we are happy with things now.*

After implementing ERP, the central warehouse and data warehouse have been linked and the company is deriving benefits in terms of inventory control.

The IT Manager explained,

See as I told you the shelf life of product is six months, if I cannot sell the product in six months that means that is a dead inventory and that is a net loss for the company. There are certain products, which are not accepted in North India and which may be accepted in South India or West India or any other location, so if one product is not selling well in North India, we can always offer that product to South India or all other franchises not there in North India, but in Central India or South India or West India...we have five shops in some areas, suppose you are sitting in Delhi, we have a number of shops in Delhi, so every shop can log in into the central data warehouse and see...if one product is not there, the inventory has finished in that particular shop, we can always refer to the second shop, I mean either ask customer to go to that shop or he can always ask for that product to be sent to his nearest store.

The next section describes the implementation success factors explained by the Manager-Systems, IT Manager and Executive-IT. The IT Manager acted as a project champion for the ERP project. He has an Engineering degree along with a Masters in Management. The Manager-Systems was in-charge of technical issues arising in IT projects. The Executive (user) in the interview was from the IT Department.

6.5.3 Critical success factors

6.5.3.1 Introduction

In the following sub-sections, the field data on key ERP implementation success factors is presented.

6.5.3.2 Top management support

Both the IT Manager and the Manager-Systems considered top management support and active participation significant for ERP project success. Top management participated in

the selection of the ERP vendor, project planning and in allocating resources. However, according to the IT Manager, top management most crucial role in the entire ERP project was assisting in increasing the level of ERP acceptance in the company.

> *I don't know whether you know or not, there are very high failure rates of implementing ERP, so ERP is not software that can be implemented very easily, it requires a total commitment from the management. If management is not involved or not committed to implement that software, you cannot expect that software to be implemented well in the organisation. So the first thing is that there should be commitment from our senior management, there should be a driving force while implementing this ERP, by hook or crook...by leaving it to the IT department or other few functions you cannot implement ERP in a company (IT Manager).*

The Manager-Systems also added management support is needed to convince personnel in the firm about the new system. Staffs in the firm also have to learn about the new ERP system and that is one of the reasons for reluctance to adopt new technology.

> *It is a very painful process because it requires lots of changes in your processes, in your company, all kind of things. People are used to work on legacy system, which are very easy to handle and very user-friendly, very convenient to work with, but when you are shifting from a legacy system to ERP... people have to learn again.*

The Manager-Systems also stated that management support is required during implementation and it was always available in this company. He said primarily because it was a management decision to have ERP, but still management has to be influenced some times.

> *Sometimes to get the budget sanctioned, you have got to influence your management also to get things done. Things, which may not be beneficial at that*

moment but may be beneficial after six months or say one year...So it is these kinds of issues we face that normally require management support.

6.5.3.3 ERP team

Both the IT Manager and the Manager-Systems described the use of an in-house ERP team with staff from different functional disciplines. The in-house ERP team consisted of about 8 members, of which, 5 had business knowledge and the remaining had good technical background and knowledge. However, it was not a dedicated team for project activities during the entire project duration. Therefore, sometimes it was hard to get enough time for the project as personnel were working simultaneously on their day-to-day company work and the ERP project as described by the Manager-Systems,

We had a team, but team members' involvement in the company's day to day work did not give us enough time. Sometimes team members did not want to stay after office hours so we faced these issues and I think all companies go through this...

6.5.3.4 Project planning

Both the IT Manager and Manager-Systems agreed that project planning carried out in great detail at the beginning of the project facilitated the project. A series of ERP project activities were identified, defined and tasks were assigned among project stakeholders.

The Manager-Systems explained,

We had three basic groups - steering group, project management group and in-house ERP implementation team. The steering group included top management and project champion. The project management group had heads of all departments and myself, IT Manager. Yes, I forgot to say, I was also part of the steering group.

So both the groups attended meetings on project planning but basically the steering group took most of the strategic decisions.

6.5.3.5 Vendor selection process

The choice of vendor was based on the recommendation by another company. The Chairman of the company took the initiative to implement the same system that was running successfully in another company. However, the other company's business practices were not similar to this firm. The IT Manager indicated that more time should have been spent on vendor selection and it should have been based on the firm's own requirements rather than following the recommendation given by another company.

As observed by the IT Manager,

So we started the evaluation of ERP in 1999, at that time we evaluated Navision. We also evaluated few more customised ERP solutions specifically for the garment industry and then we evaluated Imaging Pro also, so in fact Imaging Pro was running in DCM, I don't know whether you have heard about DCM. Our Chairman was also more interested in going for the same ERP, because it had given good results to DCM.

6.5.3.6 Communication

Case study participants described how an effort was made in the company to have effective communications between all three groups, that is, the steering group, project management group and the in-house ERP team members. The most common means used to discuss the project progress regularly among them and other staff was through emails, newsletters and regular meetings.

6.5.3.7 Business process re-engineering and customisation

The case study participants stated that changes to business processes were carried out to fit the software. It was considered a significant success factor by the case study participants because changes in the company processes can minimise the need for customisation. Therefore, an in-depth study of existing business processes was conducted in order to identify the necessary changes to be made to fit the software provided by the ERP vendor.

Both the IT Manager and Manager-Systems agreed that customisation of ERP leads to customised software for any company rather than having an ERP system. Modifications in the source code can lead to increased costs and implementation times.

The Manager-Systems stated,

> *Customisation can result in taking out all the best practices in the software...if there is too much customisation in the ERP, than there is no use of having that ERP running in your company.*

However, the IT Manager illustrated how it became a necessity for the company to make changes in the ERP applications. During the later stages of ERP implementation a decision was taken by the management to price clothes based on the sizes. This was not the case earlier. This change affected the entire transaction process. Accordingly, the ERP applications had to go through major changes that influenced the implementation duration.

> *...in our industry as I told you, we have style, we have colors and we have multiple sizes, so in the case of children's wear, our pricing is dependent upon the size...the management thought that we cannot have the prices of a small size the same as for XL sizes, so they decided to change the pricing, so small sizes will have a different price to extra large...so when you are designing your software, the main thing which comes into your mind is the master, which drives all your further*

transactions and everything, so now they ask us to change master screens only, so I mean if you are changing the master screen that means you have to rework the entire software for that, but it was a management call and they said that this is a business need and you have to do it. So these changes keep coming up in our industry (IT Manager).

6.5.3.8 Training process

Training strategies were developed in advance. During the project planning phase, most of the concerns with regard to training were addressed, for example associated costs, time plan, and selection of personnel from different functional disciplines to be trained.

According to the IT Manager a dedicated place and time for the training was scheduled,

When we started implementing Imaging Pro, so we decided to have a training session not in the office, we had a room in hotel and we asked our employees to go there because sitting in the office, you have lot of distractions like your phone calls or someone is coming to meet you. It was 7 days training aimed at all ERP team members.

The Manager-Systems also stressed the importance of continual user training,

We normally conduct training after three months for new recruits and update others. If we are introducing new technology or introducing any kind of software in the company, we always stress user training...

6.5.3.9 Other key success factors

Users' acceptability of the ERP technology was considered as another crucial factor that made implementation successful. Although the company has faced few problems in

changing the mindset of personnel, as described by the IT Manager, the firm convinced the users by making them understand how ERP can increase their work efficiency.

> *...legacy systems are designed as per your requirement, ERP is design as per based on best practices in the industry, so personnel have to change as per the software, which I mean users are not interested in changing. But users became convinced once they start learning and see the benefits...we trained them to make them understand that things are changing very fast and you have to cope with these things.*

Although users' feedback is considered to be important for implementation success, getting incomplete and incorrect feedback can affect the project progress. This has happened in this firm. The IT Manager suggested it is important to consider only relevant feedback by users to minimise incorporation of frequent changes. Receiving feedback from users was not always easy as the IT Manager observed,

> *...the user is always a problematic case in any kind of ERP implementation. Whenever you go and interact with the user, the user will never take you seriously as far as the software is concerned, they will never give you complete feedback. They will always come and give you feedback in bits and pieces, say today if they have some problem, they will come to you and explain that problem, tomorrow they will face some other problem, so they will not sit back and evaluate the thing completely.*

6.5.4 Summary

Summary of key implementation success factors are shown in table 6.15.

Table 6.15 - Summary of key implementation success factors

Emergence of idea: internal or external	Internal - Chairman
Reasons for ERP implementation	To control inventory and to have real time information
Top management support	Active participation and support involved
ERP team selection	Cross-functional team but not dedicated completely to ERP project
Project planning	Detailed project planning
Vendor selection process	Based on another firm's recommendation
Communication	Effective communication maintained throughout the project
BPR and customisation	Few modifications were made in the existing processes to keep customisation levels low
Training process	Formal ERP training provided
Implementation strategy	Step-by-step
Users' feedback	Received frequently
Users' resistance	Found initially

Source - Compiled by the author

This case can be summarised as:

a. A step-by-step implementation strategy was chosen by the firm because the ERP modules could be chosen based on the availability of resources. Further, step-by-step implementation was chosen to ensure that other departments were not affected if the implementation was unsuccessful in one department.

b. The firm received top management involvement in most of the important ERP project activities such as vendor selection and project planning. However, top management crucial role in entire ERP project was through assisting in increasing the level of ERP acceptance in the company.

c. Sometimes the ERP team was not able to give sufficient time to the ERP project because the team members were working simultaneously on their day-to-day company work and the ERP project.

d. The IT Manager indicated that more time should have been spent on the vendor selection process and it should have been based on the firm's requirements rather than following the recommendation given by another company.

e. The firm had to go through major changes in the ERP applications due to changes carried out in the transaction process. This contributed to the extended implementation duration.

f. Incomplete and incorrect feedback from the users led to the incorporation of frequent changes in the ERP system. This slowed down the ERP implementation.

6.6 Case study 6

6.6.1 Introduction: firm's background and ERP implementation status

Firm 6 has been in the business of cable manufacturing since 1970. It has two units for manufacturing instrumentation and specialty cables for the power and industrial sector. Both the plants are located in Noida (in Uttar Pradesh), India. The product range includes auto cables, jelly filled telephone cables, electric cables, cables for general purpose and stainless steel wires. The company has about 4.0 billion INR (approximately 60 million GBP) turnover and about 300 employees.

At the time of the interviews, this company was undergoing production capacity expansion programmes to meet the increased demands from the housing and construction sectors in India. To support this expansion, the company has sought to enhance the IT infrastructure of the firm. ERP has been implemented in the firm with the key objective of enhancing business productivity. According to the General Manager (finance),

> *Our company is going through a growth phase- our turnover has increased almost 50 per cent in the last two years, manpower has increased, customer demands are increasing...to cater for customer demand we have recently built a new manufacturing plant. So we wanted an application that can allow full integration of all the resources, improve inventory turns, operational stability and of course increased productivity and with ERP we have experienced improved customer satisfaction.*

The Assistant Manager (IT) said a key motive was to implement a manufacturing module but other modules like sales, marketing, production, purchase, finance and accounts modules were also implemented. It was felt necessary to streamline all the business processes to get the full benefits of ERP.

According to the Assistant Manager,

> *...we have implemented the maximum number of modules so that everyone in the organisation can share the same information to help in making the right decisions by the right people and most importantly at the right time.*

It has taken almost two years for the firm to implement the ERP system. The two main reasons for delay in the project were changes in the implementation team and difficulty in aligning the international version of the ERP application solution (supplied by BAAN) with the Indian localised version. Furthermore, at the same time as the ERP implementation, a new manufacturing plant was being constructed. This has taken the time of top management and hence they were not completely focused on the ERP implementation.

> *Two main things have delayed our project. First I can say we had numerous difficulties in integrating the localised software (Indian version) with an international version supplied to us by the vendor and secondly, there was no consistency in our team and the implementation team..from our team we saw two changes in Project Manager. In India the demand for ERP people is high and implementation team members were changing frequently (General Manager).*

Initially users' resistance was found to be high in this firm. Scarcity of office personnel was also reported in the firm during the ERP implementation period. The Assistant Manager noted that company did not have an IT Manager for the last few months.

Table 6.16 shows a summary of the firm's background and ERP implementation status.

Table 6.16 - Summary of firm's background and implementation status

Year of establishment	1970
Number of employees	300
Annual turnover	4.0 billion INR (around 60 million GBP)
Industry	Manufacturing-cables
Year of ERP implementation	October 2004
Implementation duration	2 years
Estimated ERP cost	1.0 billion INR (approx. 15 million GBP)
Implementation strategy	Big bang
ERP vendor	BAAN
Project champion	Assistant Manager (IT)
Project team members	25
Number of end-users	50
ERP modules implemented	sales, marketing, production, manufacturing, accounts and finance
Status of ERP modules in the system	Implementation complete
Configuration	Completed
Manual or legacy system in use with current ERP	Partly
Operation of business	Smooth
Upgrade to next ERP release	Not planning
Interviewees	General Manager (Finance), Assistant Manager (IT) and Hardware Engineer

Source - Compiled by the author

The Assistant Manager (IT) reported that the ERP implementation process consisted of the following steps:

1. Initiation stage
2. Study of existing working style
3. Vendor selection
4. Study of new ways of working

5. Updated hardware and software
6. Team selection
7. Training
8. Loading of ERP software and data from legacy system to new ERP system
9. Configuration
10. Pilot testing and project go-live

6.6.2 Level of success

Both, the General Manager (finance) and the Assistant Manager (IT) noted that the company had gone through many challenges while the ERP deployment was on-going, but finally it has been implemented completely and successfully (table 6.17).

According to the General Manager (finance) implementation of the ERP project has resulted in improved business performance in the following ways,

> *...it is certainly a success. It is giving us the desired benefits that were thought like smoother flow of information across all functions and locations within the company, production cycle times have reduced, increased inventory turns, increased flexibility, desired reports, timely decisions...and orders reaching customers on time.*

Table 6.17 - Implementation success indicators

	Full implementation success	Limited implementation success	Implementation failure
Time schedule		Delayed	
Budget		Exceeded significantly	
Users	Satisfied		
Benefits gained	Most of the benefits gained		

Source - Compiled by the author

The next section describes the implementation success factors as explained by the General Manager (finance), Assistant Manager (IT) and a Hardware Engineer. The General Manager was involved in making key decisions and solving project related issues. The Assistant Manager (IT) acted as a project champion in the absence of an IT Manager. The Assistant Manager (IT) had a strong technical background. The Hardware Engineer was in-house ERP implementation team member.

6.6.3 Critical success factors

6.6.3.1 Introduction

In the following sub-sections, the field data on key ERP implementation success factors is presented.

6.6.3.2 Top management support

Top management support was considered very important by all three case study participants. According to the General Manager (finance), they have helped in providing additional manpower, extra finance, project planning and in vendor selection. However, according to the Assistant Manager (IT), top management involvement with the project reduced over time. After 3-4 months they began to consider the ERP project more as an IT project rather than business project.

The Assistant Manager stated,

> *Any ERP needs top management support and in our firm in the beginning it was top management driving the project but their involvement and enthusiasm decreased with time, especially when we started having problems with software...then it began to appear it was the IT department's responsibility to implement and slowly and slowly interest among top management and employees reduced. Convincing top*

management about increasing implementation costs was also another difficulty especially when the Manager (IT) left the firm.

The Hardware Engineer also felt the ERP project was largely IT driven during the later stages of implementation.

It was OK in the beginning, management was guiding us... coming to meetings, looking at our progress, involving more and more people - but when IT related problems started...we found more IT involvement and no one wanted to say it is getting delayed because of them (Hardware Engineer).

6.6.3.3 ERP team

The in-house ERP team was selected based on their high motivation, IT ability and interest in learning new technology. However, the ERP team had to be changed when four staff in it left the organisation during the implementation process. The ERP team actively participated in convincing and explaining to users that ERP will increase their work efficiency.

Both the Assistant Manager (IT) and Hardware Engineer highlighted the importance of a committed and dedicated team.

Every team member is like a pillar, providing strength to the project. Without a good and committed team, the ERP project becomes more complicated. We have seen this ourselves in our company. Frequent changes in our team affected the working of everyone and the project progress. Our initial team was very good but later on with problems arising...people leaving the organisation...we never had one team, which is very important to complete the project on time (Assistant Manager).

6.6.3.4 Project planning

The Assistant Manager (IT) stated that the project scope was agreed in detail in several meetings attended by the external implementation team, top management and the internal implementation team. Every effort was made by the company to follow the timelines and these were revised if needed. However, this practice of following the time schedule could not be maintained throughout the implementation duration.

The Hardware Engineer who was involved in the ERP implementation described this in the following way,

> *...all the details were available on paper but we were missing project direction, when many challenges started to appear all of a sudden, like software not integrating and too long spent in studying the complicated business processes in cable manufacturing, it was mainly the IT department involved...*

6.6.3.5 Vendor selection process

The process of vendor selection was considered important by all the three case study participants. The Assistant Manager (IT) stated that BAAN was selected mainly because of the low cost compared to other market leading vendors. However, the choice of the wrong international version meant that the system did not integrate easily with the Indian localised version.

According to the General Manager (finance),

> *We spent 2-3 months in selecting a right vendor and implementation partner. The main reason for selecting BAAN was their competitive rates that they provided us as compared to SAP and Oracle. Quotations and details on the products were taken from SAP, Oracle and BAAN...another reason was they are in our competitor's*

company with a similar business to ours. We thought it would be easy as our processes are similar to theirs...

6.6.3.6 Communication

The Assistant Manager (IT) felt that not enough effort was made to increase the level of communication about the ERP project in the organisation. However, monthly meetings were conducted among ERP team members across different departments to update on project progress.

The Assistant Manager described the importance of effective communication,

Effective communication is very important among different departments to exchange information on project activities and tasks completed. If there is a lack of communication even from one department it affects the whole chain of ERP progress. Until we get desired data and information from that department we cannot continue...this is most important during the business process study.

6.6.3.7 Business process re-engineering and customisation

BPR was conducted to fit the company's business processes to the ERP software. The Assistant Manager (IT) expressed the opinion that it is very difficult to get an ERP package that can deliver all the requirements of any company. In this company, efforts were made to align the business processes according to the software package but still customisation was required due to the complex nature of cable manufacturing process.

According to the Assistant Manager (IT),

It is very difficult to get the system that we want, so every company has to customise according to their requirements. We did lot of customisation because if you implement ERP in the service sector you find it easy because the chances of

getting standardised software is higher. In our company there are 20 types of cable manufactured...all with different production and with different parameters. They all go through different manufacturing processes...we had to spend time and money but customisation was needed here...

6.6.3.8 Training process

According to the Assistant Manager (IT), training is important for making ERP implementation successful. But it is more important to see the amount of training understood by those taking part in the training.

Training is one thing that is provided in almost every organisation where ERP is implemented but I can say two things are very important related to training. The first thing is when the training is provided. Ideally it has to be given in phases and secondly you need to find out the absorption of knowledge and learning by users from the training - to see how much of the knowledge they can apply in a real ERP implementation (Assistant Manager).

Training has been given to 25 staff in this organisation. In addition to end-users, training on basic ERP concepts was conducted for all Head of Departments and in-house core team members. Training was provided by the implementation partners who were stationed at the head office of the organisation during the training period of two months.

The Hardware Engineer noted,

For the IT Department, the focus was more towards technical training. Other departments got functional training and users got mainly training on how to do data entry.

6.6.4 Summary

Summary of key implementation success factors are shown in table 6.18.

Table 6.18 - Summary of factors related to successful ERP implementation

Emergence of idea: internal or external	Internal
Reasons for ERP implementation	To enhance production
Top management support	Support was there but it decreased over time
ERP team	Frequent changes in the team affected the project progress
Project planning	Detailed planning on paper but was not always followed
Vendor selection process	Based on cost effectiveness and implementation in a competitor's firm
Communication	Not very effective
BPR and customisation	BPR was conducted to fit the ERP software
Training process	Customised training provided
Implementation strategy	Big bang
Users' feedback	Feedback was taken during testing phase extensively
Users' resistance	Users resisted initially

Source - Compiled by the author

The following points can be emphasised from this case:

a. The implementation duration got extended. The main reasons for delayed implementation were difficulty in integrating the Indian localised system with international ERP package and frequent changes in both the internal and external ERP implementation team.

b. The project started with the enthusiasm and full motivation among top management and team members but as challenges started occurring and were not being solved on

time, then it was considered more of an IT department's responsibility to implement ERP in the organisation.

c. Emphasis was placed on training but after training a number of personnel left the organisation. Replacing these personnel and training them took time that affected the project progress adversely.

d. Vendor selection was mainly based on the ERP cost offered by market leading vendors.

e. Efforts were made to align the business processes according to the software package but customisation was required due to the complex nature of cable manufacturing process.

6.7 Case study 7

6.7.1 Introduction: firm's background and ERP implementation status

Firm 7 was established in 1997 and employs about 200 people. It is located in Gurgaon (in State Haryana), India. The company manufactures designer wear using handwork embroidery, chain stitch embroidery, batik, appliqué work and hand processes like hand crinkling. Most of the hand process work in the production of clothes is generally subcontracted and there are hundreds of artisans and craftsmen distributed in Northern India who work for the company on contract basis.

All the products are exported to USA, Canada and Japan. Customers are leading international brands like Gap, Polo jeans, Boden, Jigsaw and Guess Jeans. The company's priority is to provide quality products to its customers through a total quality management program. It puts quality checks on the raw materials to produce defect free garments that do not need any alterations or repair. The company is also committed to time bound deliveries at globally competitive prices.

The Managing Director of the company initiated the idea of ERP in the organisation. A Director of the company stated during the interviews that, in his view it was important to have ERP to streamline the business processes and to have information on the status of the production processes.

> *There were many reasons for implementing ERP. Our company has a turnover of 1500 million INR and still all the stocks were manual. When a product requirement came in, there were many ledgers and it was hard to find out what is available. It was causing a loss to the company. This is only one example, there were many other processes in the business that required streamlining.*

The ERP project began in 2005. An Advisor (technical) has been involved in the ERP implementation and has acted as a project champion.

> *The initiative was taken by the management itself but I was personally involved in it. For last 3 to 4 years they were thinking of implementing ERP ...they short listed a local ERP vendor (Orega software) and we started implementing ERP... I am a technical consultant, thus, myself and the Manager (IT) keep on improving the ERP as required.*

ERP implementation process consisted of the following steps:

1. Management decision on ERP
2. Project planning
3. Vendor selection
4. New computer installation
5. Installation of ERP software
6. Training as and when required

IT Manager explained a step-by-step approach was adopted for the implementation process. Though implementation and customisation was on-going, he summarised the process as,

> *We are in the garment industry and the ERP we took needed customisation...The first module we did was merchandising. When we receive a purchase order we enter it into the computer so we employed one person in the Merchandising department to feed the orders in the system, then we also start training the merchants themselves to learn entering and helping him. So gradually in about two months all the orders are entered on the computer. Next phase is to enter the bill of materials, items quantities code, colors, combinations etc. If you enter a label, it*

will automatically calculate the sizes, and if you enter thread per color it will automatically calculates the quantity and so on the merchant generates a bill of material based on the purchase order. This is the second step which we did in about two months.

After this is done, then there is the process of approval. No one in the company can change the system once the merchant freezes it, only the merchant's boss can defreeze it. Once a bill of materials is entered it is sent directly to the purchase Manager to purchase from parties mentioned as per the purchase order. When the material comes it is entered into the stores. Then we started the production module and we kept on doing one by one. For production we put a person there who enters the incoming and outgoing material...just this...very simple and this links every department and every style and automatically this happens, so we are now at the dispatch stage, this we have yet to do, packaging we also have yet to do, that is separate, also bill passing we have not taken, and HR we have not taken which we are in the process...

The firm's background and ERP implementation status are summarised in the table 6.19.

Table 6.19 - Summary of firm's background and implementation status

Year of establishment	1997
Number of employees	200
Annual turnover	1.5 billion INR (21.5 million GBP)
Industry	Manufacturing-clothing
Year of ERP implementation	December, 2005
Implementation duration	Not completed
Estimated ERP cost	10 lakhs INR (12,000 GBP)
Implementation approach	Step-by-step
ERP supplier	Orega (local ERP vendor)
Project champion	Advisor (technical)
Project team members	4
Number of end-users	15
ERP modules implemented	Merchandising, purchase and production
Status of ERP modules in the system	Still in the implementation process
Configuration	Not yet completed
Manual or legacy system in use with current ERP	Is in use simultaneously
Operation of business	Still business functions are not integrated
Upgrade to next ERP release	No
Interviewees	Director, Advisor (technical), Manager IT and Manager HR

Source - Compiled by the author

6.7.2 Level of ERP implementation success

Though the company started the implementation process in December 2005, it was still ongoing in March, 2007.

The IT Manager explained the ERP implementation was ongoing because of the complexity of the project and that it involved most of the departments to co-ordinate and to complete the all stages of product manufacturing.

> *It is still under implementation, it is a very vast process as all departments have to coordinate when they make an order. They make bill of material, according to that bill of material the purchase department orders accessories which are then issued to various production departments. After issuing the raw material there will be a flow from cutting the fabric to dispatch of finished goods, so all the stages involved in this are covered. So involving all these processes is not easy and takes long time (IT Manager).*

However, there appears to be a difference of opinion about the level of success achieved, with the following views expressed by the IT Manager,

> *If you ask me it has not been planned well and everywhere they are talking about it, in my view it has not been success. The company has not got any benefits as our Advisor was telling you. How can we get benefits when it is not implemented completely? ERP is not ERP if all business functions are not linked to each other.*

As the process of implementation has not been completed successfully, the company is still using its legacy systems (for instance Tally software for accounts).

The Manager IT stated that,

> *The basic thing is good adaptability of Tally software, no one wants to shift from Tally software, which is very user friendly and fast, to the ERP system. Initially we have to be sure of 100 per cent accuracy of this ERP software, only then can we shift to it completely. Once data is entered in the ERP system then it is also entered into Tally. For example when a party bill comes with goods at the gate to accounts*

it is reentered in Tally because people are used to Tally and we have not yet integrated accounts department with other departments.

Some of the business transactions were performed manually because there is a lack of confidence about the new system.

It is parallel, initially and also now manual work is done as when a new system comes nobody is sure of its potential or accuracy. Suppose you become dependent on the new system and the system crashes. We do not know how this new system will cater to our needs. So the manual systems and computerisation are going on simultaneously until the management is satisfied that a system is 100 per cent OK. Only then the manual work will be stopped (IT Manager).

The case study participants agreed that implementation has not been completed on time and within the planned budget. One of the reasons was initial resistance by the users to adopt the new system.

It has overrun...as there was initial resistance by users to adapt to the new system, as they have to do things manually and on the system and learn new features as well. Basically 90 per cent of users resisted the change (Advisor).

The Advisor (technical) admitted that users and other employees of the organisation were not told initially about management's decision to adopt ERP. Thus, most of the users had been asked to use the new system but it was not explained how the new system would improve their work efficiency and the other kind of benefits that can be derived from ERP systems once implementation is complete. Furthermore, users' feedback was not considered important during ERP implementation.

According to the Advisor,

People did not know how ERP can be useful to them and the company. They did not have the correct information at all...whatever they knew was not good. They were scared about their jobs and thought they would be less important because after implementation if the Managing Director sees all reports on his screen, he will not call on the staff. These are the basic reasons why users do not want to use this new ERP system.

According to the IT Manager also,

Only 10 per cent people approved the idea and 90 per cent people were resistant to this new system.

Table 6.20 summarises implementation success indicators of this firm.

Table 6.20 - Implementation success indicators

	Full implementation success	Limited implementation success	Implementation failure
Time schedule			Incomplete implementation
Budget			Over budget
Users' satisfaction			Very low
Benefits			Very few benefits have been observed

Source - Compiled by the author

The interviewees' views on the importance of implementation success factors are discussed in the next section.

6.7.3 Critical success factors

6.7.3.1 Introduction

In the following sub-sections, the field data on key ERP implementation success factors are presented.

6.7.3.2 Top management support

The Advisor (technical) and the IT Manager both stressed the importance of management support in an ERP project. However, in this case, IT staff played the main part in the implementation process. Top management supported them but their involvement was found to be lacking.

The Advisor (technical) stated,

> *Yes, top management support is an ongoing process. For implementing ERP the internal support is very important and in India there are vested interests. Unless there is unconditional management support it cannot be implemented, in our case we had that. Whenever we have problem we discussed it with them but it was basically IT people who were involved in the implementation process. We informally kept on discussing the matters but there were no formal meetings planned with the management.*

6.7.3.3 ERP team

The Advisor (technical) and IT Manager agreed that they did not have a dedicated in-house ERP team. It is clear from the following statement that in their view only IT personnel are required for the implementation and other personnel are needed only for data entry.

As the Advisor (technical) observed,

Our IT section has three personnel only and the ERP system has been implemented by him (Manager IT) and me. We had 5-6 people in the beginning to facilitate entry of data from our vendor now our own people have to do it themselves. We do not have any people for ERP only. We need people for data entry only...

However, the IT Manager admitted that an in-house team is very important for successful implementation. During his interview he further added that there is no ERP in-house team who is responsible for the progress of the project. Additionally he noted that the project champion has worked for the organisation for many years and he does not want to give duties to other staff members, rather he wants to make all decisions himself.

The Manager IT said,

I have more technical background than him but he will do things in his way. He thinks he has experience but the ERP is still ongoing...I have told him again and again to form an ERP team but he will not listen.

6.7.3.4 Project planning

The IT Manager and the Advisor (technical) agreed that project planning is important to complete implementation on time. However, they stated that they had not spent time in planning. Rather the emphasis was on implementing the software as soon as possible and to start entering the data on the system.

As the Advisor (technical) reported,

All the planning was done by the Directors of the organisation, but mainly about ERP costs like computer costs, software costs, vendor costs etc. No detailed plans were made about ERP project activities. We all wanted to start the process of loading the software.

6.7.3.5 Vendor selection process

Although the ERP project champion seems to know the importance of appropriate vendor selection, the main criteria for vendor selection was the ERP cost and simplicity of software rather than on suitability for the company's business processes.

The Advisor (technical) explained,

> *Vendor selection is very important for successfully implementing ERP. I would say 30 per cent of companies fail due to the wrong vendor selection. In our case we talked to SAP, we talked to Oracle, and found that the costings were high and they did not respond. We talked to a couple of other parties who were making ERPs for the garment Industry. We knew our cost will be around 5 million INR to 10 million INR, we checked vendors and found one company which was very cheap with the whole package costing 10 lakhs INR. Our ERP supplying company is very small with 100 clients and I can talk to the owner whenever I need to and his response is very nice. Thus, we got this company which gives us personalised attention whenever we need it and at a low cost. Also they have simple software and our people can manage to operate it. Later on I would like to shift to a reputed...*

He also said,

> *I find the failure rate of SAP high in India in small sized companies, it is not because they are technologically bad but because they are very expensive for customisation. And companies find it difficult to continue if lots of customisation is needed. In our case we are happy with our vendor. You see ERP is such a complicated package that if you touch one thing it has an impact everywhere...and it becomes unstable. Normally ERP should not be touched. In SAP and Oracle a lot of customisation can happen on screen...small packages do not have that option.*

6.7.3.6 Communication

The project champion and IT Manager seem to know the importance of effective communication. However, employees of the organisation were not been informed and updated about project progress on a regular basis. This might be one reason for observing high user resistance in this case.

6.7.3.7 Business process re-engineering and customisation

The business processes of this company were not studied before initiating the ERP and only few modifications were made to them.

As the Advisor (technical) observed,

> *No changes we made in our working. People know their work operations. It takes time to change operations, thus, we are changing ERP software as and when required.*

The Manager IT also noted that business processes were not studied and were being performed as before. Rather, the ERP software has been loaded and changes were being made to it according to the company's work processes.

6.7.3.8 Training process

Both the Manager IT and the Advisor (technical) agreed only limited training was given.

According to the Advisor (technical),

> *Sometimes we called some software people and had small training sessions. No substantial training was given as people need to know only how to enter their own data. In our main functional areas we have one person from the IT dept. So where there is extensive use and less people we put that person full time and where there*

are more people and less use we put one expert in the whole department. This way we saved training cost and managed people.

6.7.4 Summary

The main emphasis of the ERP implementation process in this firm was on the selection of vendor and installation of ERP software. Importance was not given to detailed planning, selection of a dedicated team, study of business processes, formal training or users' feedback.

Table 6.21 - Summary of factors related to successful ERP implementation

Emergence of idea: internal or external	Internal: Director of the company
Reasons for implementing ERP	To streamline the business processes
Top management support	Support was there but not involved in the implementation process
ERP team selection	There was no formal ERP team constitution
Project planning	Done by Directors but not on a detailed level
Vendor selection process	Based mainly on cost and software customisation
Communication	Effective communications could not be maintained
BPR and customisation	Rather than making changes in the business practices, customisation was preferred
Training process	Training as and when required and mainly for data entry
Implementation strategy	Step-by-step
Users' feedback	Not considered important
Users' resistance	Most of the users resisted

Source - Compiled by the author

The following points can be highlighted in this case:

a. The case study participants agreed that the ERP implementation could not be completed on time and within the planned budget. The reasons for it were initial resistance of users towards the ERP system.
b. Top management supported the implementation process but their involvement in key implementation process was found to be lacking.
c. Users' resistance was observed. Due to ineffective communication, users were not updated about the ERP implementation activities in the firm. It was not explained to users how the system would improve their work efficiency and other kind of benefits that can be derived from ERP systems once its implementation is complete.
d. Due to the absence of a dedicated ERP team, project timelines were not met.
e. Vendor selection was primarily based on the ERP cost rather than based on certain predefined criteria set by the top management or the implementation Manager.

6.8 Case study 8

6.8.1 Introduction: firm's background and ERP implementation status

Firm 8 manufactures telecommunication and power cables and was established in 1954. It has integrated manufacturing facilities at Faridabad, Haryana and New Delhi, India. The company supplies to the power and telecommunications sectors in India and abroad. The major clients are Bharat Sanchar Nigam Limited, Bharti Infotel Limited, Bharat electronics limited, Electricity boards, Nuclear Power Corporation of India and National Thermal Power Corporation. The company employs about 180 personnel and has about 1.2 billion INR (around17 million GBP) turnover.

In this firm, tailor made cables are made based on customer specifications. According to the case study participants IT has played a major role by contributing to customers' satisfaction and company growth. In 2001, the IT Department took an initiative to implement ERP in the firm to capture day to day factory operations.

The Director of the company reported,

> *During 2001 in February-March, the company realised the need for rebuilding its IS from standalone databases to a centralised database. The initiative was taken by the IT department and the Head of IT suggested to management the implementation of ERP to capture day to day operations of the factory. Another reason for ERP was to encourage employees to work systematically. See there were many other reasons for us to implement ERP like our business was growing, demands for our products were increasing so production had to be increased. The head of IT suggested that implementation of ERP was the way to solve the challenges facing the business.*

Implementation began in February 2001 through a local ERP vendor but was stopped in March 2002 completely.

The Head of IT expressed the following views,

> *ERP started in 2001 but was discarded in 2002. After spending almost one year, it was a total failure. 80 % of our time and our implementation partner's time was devoted and after that it had to be stopped because the system was not working. We gave 25 % of total implementation cost to the implementation partners but they left us in the middle. We could not do anything because you know Indian laws and we did not want to spend time in courts...*

The Director of the firm felt the vendor was to a large extent responsible for the implementation failure as they showed no commitment and interest in learning how the firm operated. In his opinion it was not a good start. In addition, vendor support was not always available during implementation. The key issue responsible for implementation failure in 2001-02, as described by the Head of IT, was a lack of understanding of business processes by the vendor and employees of firm that led to continuous customisation of the ERP software.

Head of IT explained,

> *There were many problems in the ERP system...a major problem was the lack of understanding about the business processes of the firm in the vendor team and technical data providers in the factories. For example, it was not clear how much raw material was required in a particular phase of the specified cable manufacturing process. And we were not getting consistent figures. Two people from the same factory were giving different data. The vendor's team spent a long*

time in understanding our business processes but they did not understand basic calculations that are required in wire manufacturing.

Although firm 8 has gone through an unsuccessful ERP implemcntation process, the case study participants were still interested in adopting new technologies, and a new ERP project was started at the end of 2004. At the time of interview, the Director described how an in-house ERP implementation was underway since November 2004. The decision on an in-house implementation had been taken because of the previous unsuccessful attempt at ERP implementation through a vendor.

According to the Head of IT,

Now we are doing in-house ERP, we will know where the problem is- if the system is not working or employees are not working...

Before initiating the new ERP implementation, investment costs were calculated and looked at by the finance and IT departments together. The main investment costs included software costs, hardware costs, maintenance costs, training, infrastructure costs, upgrading of the server and hiring staff that have knowledge of particular modules.

The current implementation process is being undertaken in the following stages:

1. Decision on in-house ERP implementation
2. Installation of computers and upgrading of the server
3. Formation of team
4. Installation of software
5. In-house training

Table 6.22 shows a summary of the firm's background and ERP implementation status.

Table 6.22 - Summary of firm's background and ERP implementation status

Year of establishment	1954
Number of employees	180
Annual turnover	1.2 billion INR (approx. 17 million GBP)
Industry	Manufacturing-cable
Year of ERP implementation	November 2004
Implementation duration	On-going
Estimated ERP cost	15 lakhs INR (18,000 GBP)
Implementation approach	Step-by-step
ERP supplier	In-house
Project champion	IT Manager
Project team members	4-5
Number of end-users	6
ERP modules	Sales, finance, purchase and production
Status of ERP modules in the system	Customisation in process
Configuration	Incomplete
Manual or legacy system in use with current ERP	Yes
Operation of business	Same as before
Upgrade to next ERP release	No
Interviewees	Director, IT Manager and IT-Executive

Source - Compiled by the author

6.8.2 Level of success

Both the Director and Head of IT agreed that complete success has not been achieved because the project was behind the schedule, over budget and has not provided any performance improvement to the firm so far (table 6.23).

According to the Director, ERP can provide numerous benefits (like increased operational efficiency, inventory status) only after the implementation process is completed. He spoke about the following benefits,

> *Through ERP we can see increased operational efficiency, we could see whether an order has been executed or it is in the factory or if raw materials have been purchased according to the purchase order. These kinds of things are checked through ERP...management can know what the inventories in the factory are and what the status of an order is.*

Table 6.23 - Implementation success indicators

	Full implementation success	Limited implementation success	Implementation failure
Time schedule			Incomplete implementation
Budget			Over budget
Users' satisfaction			Low
Benefits gained			Very few

Source - Compiled by the author

The next section describes the implementation success factors as described by a Director, the Head of IT and an IT Executive. The Head of IT has a Bachelors degree in IT and acted as a project champion for the ERP project. The IT Executive was from the IT Department.

6.8.3 Critical success factors

6.8.3.1 Introduction

In the following sub-sections, the field data on key ERP implementation success factors are presented.

6.8.3.2 Top management support

According to the Director and the Head of IT, management has been supportive at all the phases of implementation process.

According to the Director,

> *We have always supported the ERP implementation activities, our involvement is limited to a few project activities but we as management looked at financial needs, infrastructure improvement and manpower planning. Our Head of IT is capable of handling it on his own and he is working hard to make the implementation complete.*

The Head of IT agreed that top management plays an important role in ERP implementation success. In his opinion top management has supported firm 8 in two ways. Firstly, by contributing to changing the mindset of ERP users and secondly, providing necessary resources.

> *...Management has to be made to feel confident. Then management can communicate to all other employees that it supports the IT department. Employees may not listen us but if management tells them then they have to follow. People need to be told by the management that the system is going to help then people need to change their mindsets. During ERP implementation period changing mindsets is required. So, management has supported the changing mindset of people. Another thing in which management supported is financial support for the in-house implementation process (Head of IT).*

Regarding role of the management in the previous unsuccessful ERP implementation, the Head of IT expressed his views,

Management has nothing to do with the failure because the IT people were doing most things. Management wanted it to go well because they had paid to the vendor (25 per cent of total implementation costs). The vendor tried to implement but our business processes are complex...although the contract was signed with the vendor, the vendor ran away. We could not do anything because in India there are no check ups...

6.8.3.3 ERP team

The Head of IT acted as project champion and about 4-5 team members from IT department were involved in the ERP implementation. An absence of personnel possessing business knowledge from other departments in the in-house ERP team was highlighted by the Head of IT. Though representatives from other departments are involved in getting relevant business information whenever required, a dedicated ERP implementation team is lacking.

The Head of IT expressed the following views,

We visit the factory or people from the factory visited the Head of IT's office when we need to have an understanding or get data about the processes involved in cable manufacturing, but the factory staff are not involved fully in implementation because they are not here (in the head office) and also because of the shortage of people. If they work full time with us then who will do their work?

6.8.3.4 Project planning

The Head of IT emphasised the importance of project planning and stated that he had looked into the main project activities necessary before initiating the project. However, time schedules and project plans could not always be followed.

A good project planning structure helps you to land where you want to be. Without planning, implementation could not be finished on time. We have planned all major project details, for example when we have to implement which module and in which area...with targets defined for each one. As we all know if one project activity is delayed then all other activities are affected. But sometimes it is difficult to do what you have planned. There are many reasons for it, like shortage of manpower, incomplete technical data availability. It happens to us many times. If a target is not finished on time then postponing it for 5-6 days or a week is normal, but I feel it is not good to get more of a delay than that (Head of IT).

6.8.3.5 Vendor selection process

This firm has decided to have an in-house ERP implementation for two reasons. Firstly, standard ERP systems from global vendors may need customisation that might be expensive and secondly, the Head of IT possesses understanding of complex cable manufacturing systems.

The Head of IT described the process of vendor selection,

We are in a trade where standard ERP may not work. We have seen so many demonstrations by well-known vendors, but they do not know cable manufacturing. SAP told us they can customise according to our needs... We did not go for SAP because management was not ready to spend that much. You know SAP is expensive and if they do customisation it is more expensive. We are actually manufacturing the products and not assembling like other companies. See a normal wire, telephone wire, cable wire - they all have a different overall diameter. Their raw materials are different, the manufacturing process is different, and the purchase requirements are different. Details on this have to be calculated for each wire.

6.8.3.6 Communication

Although the project champion stated that employees, ERP team members and users were aware of the project progress, the Executive IT (end-user) felt effective communication was lacking.

According to the end-user,

> *No I think we are not told properly by anyone what is going on. We all know we are trying to make changes in our working process and ERP is being implemented. But I do not know how much has been completed or what is left. I am not involved all the time. We get information from talking to each other informally. Sometimes that information is wrong. Like some days ago we heard that very soon we will stop using manual system...*

6.8.3.7 Business process re-engineering and customisation

The Director stated they had not undertaken BPR as they did not realise the need for it. The Head of IT was not sure of this term so it was explained to him during the interview. He confessed to a lack of knowledge about business processes and their study prior to ERP implementation and felt this had contributed to the earlier ERP failure.

6.8.3.8 Training process

Interviews with case study participants indicated that no formal ERP training was provided either prior to or during the ERP technology implementation in the firm. Informal training was provided by the Head of IT to save the cost of using an ERP training institute, which was viewed as expensive. The Head of IT himself did not have formal ERP training or previous successful ERP implementation experience.

According to the Head of IT,

First 5-6 people from our head office were trained. It was operational training given by me when needed on how to enter sales orders, what and how fields in the table have to be completed. When we started using computers in our factory and head office, people were not well versed in computers. They were not ready to learn. They thought computers would make them lose their jobs. We have now trained them in basic computer operation also. Training institutes for ERP are costly and management is not ready to spend much money on them. They say I should tell people about how ERP works. So I guide people whenever I want them to know new things.

The Executive confirmed that no formal training was given,

Yes they tell us how to put data into the system but training from outside has not been given. Whenever there is problem with the system we go to the Head of IT. Sometimes they tell us what to do on the system but not always. We all are trying to learn but I think they can tell us before about common problems so we do not have to waste time waiting for some one to come and solve it for us.

6.8.3.9 Other key success factors

Though both the Executive and Head of IT felt that in this firm co-operation from some users was not present and the users were not always keen on giving feedback, they suggested without users' support implementation could never be completed successfully in any firm.

Co-operation from all users was not there. Sometimes some of them behave like children. Users understand if they enter the wrong data then the wrong reports might be generated and then questions will be raised on them. So they are afraid of using the new system. If they are forced to use it, they will do it but not with any

interest and will keep on making mistakes. Only 2-3 of us are interested. Others do not want to work on the new system most of the time. But I think without user support, implementation is difficult to complete.

6.8.4 Summary

The following points can be highlighted in this case:

a. The case study participants agreed that success has not been achieved in the ERP implementation because the project was behind the schedule, over budget and has not provided any performance improvement to the firm so far.
b. Top management involvement was limited in the ERP implementation process.
c. An absence of cross-functional ERP team was observed. Thus, team members did not possess enough knowledge on how the business functioned in various departments of the firm.
d. The time schedule of the project activities could not be followed due to the shortage of manpower to work dedicatedly on the ERP implementation.
e. No formal ERP training was provided either prior to or during the ERP implementation in the firm. Informal training was provided by the Head of IT to save the cost of using an ERP training institute, which was viewed as too expensive.
f. Users' resistance was observed throughout the ERP system implementation.

Summary of factors related to successful ERP implementation are shown in table 6.24.

Table 6.24 - Summary of factors related to successful ERP implementation

Emergence of idea: internal or external	Internal: Head of IT
Reasons for implementing ERP	To capture day to day operations of the business
Top management support	Support was available but not their involvement
In-house ERP team	No formal formation of an ERP team
Project planning	Planning has been completed on paper but delay in project activity for 5-6 days was acceptable for the project champion
Vendor selection process	In-house
Communication	Ineffective communication reported
BPR and customisation	Customisation preferred rather than modifying business processes
Training	Informal training by the Head of IT
Implementation strategy	Step-by-step
Users' feedback	Have not provided feedback
Users' resistance	Resistance was observed in the firm

Source - Compiled by the author

6.9 Case study 9

6.9.1 Introduction: firm's background and ERP implementation status

Firm 9 was established in 1985 and manufactures sponge iron. The manufacturing plant is located in the state of Bihar, India. This firm employs 270 personnel and has a turnover of around 1.75 billion INR (approx. 26 million GBP).

The main purpose of deploying ERP in the company was to resolve the Year 2000 (Y2K) crisis, since the legacy systems of the company were unable to handle the change to year 2000. The company was in the process of installing applications for solving the Y2K problem, when a local vendor suggested ERP could be cost effective for two specific reasons. Firstly, ERP application would be an immediate solution to the Y2K problem and secondly it would provide efficient business support to the company's operations in the future.

Although ERP was started in mid-1999, it has not been completed successfully. At the time of interviews, manual and legacy systems (FoxPro) were in use and attempts were being made to customise the existing ERP applications solution.

The ERP implementation process in this firm consisted of the following steps:

1. Decision to select a local ERP vendor
2. Informal training
3. Installation of software and hardware
4. Customisation of software

Table 6.25 shows a summary of the firm's background and ERP implementation status.

Table 6.25 - Summary of firm's characteristics and implementation status

Year of establishment	1985
Number of employees	270
Annual turnover	1.75 billion INR (approx. 26 million GBP)
Industry	Manufacturing-sponge iron
Year of ERP implementation	1999
Implementation duration	Unsuccessful implementation
Estimated ERP cost	10 lakhs INR (12,000 GBP)
Implementation approach	Step-by-step
ERP supplier	Alysha Software (local)
Project champion	IT Manager
Project team members	5
Number of end-users	8
ERP modules implemented	Finance, payroll, marketing and purchasing
Status of ERP modules in the system	Incomplete implementation
Configuration	Some changes are still going on
Manual or legacy system in use with current ERP	Yes
Operation of business	ERP system has not made any difference
Upgrade to next ERP release	No
Interviewees	Assistant Manager, Electronic Data Processing (EDP) Manager and Senior Executive

Source - Compiled by the author

6.9.2 Level of success

ERP has not provided most of the benefits that were promised by the vendor because the implementation has not been completed successfully (table 6.26).

The Manager (EDP) stated,

We are not getting all the benefits that the vendor told us about. I can tell you that we have only few modules and we still face problems in those...I mean we should have solved the problems in 2000-2001 but we did not. So I mean we are still doing configuration by ourselves but it is not easy.

The Assistant Manager also confirmed that integration of the business processes across the enterprise had not been achieved through ERP because of the incomplete implementation of ERP modules.

Head office and plants are not connected. There is no interconnection. Their data is separated and ours is different. Only for final reports, data are sometimes combined. Some reports we make manually or by using excel files... (Assistant Manager).

Table 6.26 - Implementation success indicators

	Full implementation success	Limited implementation success	Implementation failure
Time schedule			Incomplete implementation
Budget			Over budget
Users' satisfaction			Low
Benefits gained			No

Source - Compiled by the author

The next section describes the implementation success factors as seen by the Manager (EDP), Assistant Manager and a Senior Executive. The Manager possessed a diploma in IT. The Assistant Manager and Senior Executive both possessed bachelors degrees in IT.

6.9.3 Critical success factors

6.9.3.1 Introduction

In the following sub-sections, the field data on key ERP implementation success factors are presented.

6.9.3.2 Top management support

Top management had agreed to implement ERP systems in the firm but did not have enough information on the implementation process. The case study participants all agreed that top management involvement in the ERP project was very limited. The ERP project was driven by the IT department. The understanding of the importance of top management involvement in the ERP project was found to be lacking in the Manager and the Assistant Manager because both of them felt that ERP implementation is a technical project and it is IT's responsibility to implement it. In their view, top management role is limited to providing the financial support for the project and the IT department can handle the implementation on their own.

> *Top management role is to give orders...they say ERP has to be completed. The main problem is finance if we have that then rest is basically technical. Top management role is to give finance. They do not need to come to meetings or to be involved themselves...(Manager).*

6.9.3.3 ERP team

The firm lacked any formal ERP team, with work being allocated according to the availability of staff. Due to this, project activities were not completed by the staff as they knew they would only have to work on the ERP project for few hours or may be 1-2 days. The aim of the staff was to neglect the project activities so next time the Manager would

not approach them with more work. Top management had intervened a few times, but experienced employees were not ready to listen. Further, it was very difficult for top management to say anything to employees who had 12-15 years of work experience in the organisation, as this might cause them to leave the organisation.

According to the Manager,

> *Basically we have not formed a team. There was no choice of team as there are not enough people with IT skills. People working with us left the company so finding replacements who can take the place of these people was difficult. Most of the time people would say this is an IT project, we cannot help you...our work is already pending, we cannot spend time on it now.*

6.9.3.4 Project planning

The Manager and the Senior Executive noted that the ERP project was initiated to solve the Y2K problem. The purpose was to implement ERP as early as possible so there was insufficient time to do project planning. Moreover, neither top management nor the local vendor provided enough information on the steps involved in ERP. The Manager indicated it was his first implementation and he had no prior experience of any other IT technology implementation, so he himself was not aware of the project planning required.

The negative view of Senior Executive about meetings to discuss project progress can be seen in the statement given by him.

> *I think there was no planning. Meetings were held, but generally not planned. Their (vendor) office is nearby so they came whenever there was any problem. If they were not in the office, we could contact them later, some days we were meeting with them everyday so I think there was no need for meetings. Yes sometimes our*

management was meeting but I think meetings are not important they take time and management is very busy (Senior Executive).

6.9.3.5 Vendor selection process

There were no predefined set of criteria for selecting a suitable vendor. The vendor was selected mainly based on their low ERP implementation cost. Although the selected vendor had unsuccessful ERP implementations in other firms, they were still considered for implementation in this firm. Attempts were not made to understand why ERP implementation by the vendor in other firms had been unsuccessful.

As the Manager reported,

The Y2K thing was there so we were in a hurry to implement, so we just went for it... cost was important so went for a local vendor...

6.9.3.6 Communication

The Manager described how user resistance was present throughout implementation because of the lack of effective communication between top management, Managers and users.

Co-ordination and communication between vendor and users is important or say between developer and users is important...if users can not communicate with developers then developers can not understand users needs so there has to be effective communication. But as I told you before users were not ready to accept the new system, so they did not want to talk to developers... (Manager).

6.9.3.7 Business process re-engineering and customisation

None of the three case study participants were aware of the term 'BPR'. When the meaning of the term was explained to them, they all agreed a business process study was not conducted and processes were not modified because the purpose of ERP implementation was to have a customised ERP. The vendor being a small company with only 1-2 years of experience did not have any standardised software for the company. Both the Manager and the Senior Executive noted that the ERP software was developed for their particular company, so it was fully customised.

> *...instead of looking at business functions we started making changes in software...it was fully customised, no changes in processes were done, it was developed by vendor for ourselves as they were in the process of establishing themselves.*

6.9.3.8 Training process

There were only informal training sessions held with the local vendor, however, the local vendor themselves did not have significant ERP knowledge and implementation experience. The Manager who acted as a project champion also did not have any previous experience of ERP implementation, nor did he undergo any kind of training. There were some people in the organisation who had not used computers before so they were told how to use them. Informal training was given only for a few days to users about how to use the ERP system for their work. The emphasis was mostly on technical training rather than on the overall concept of ERP and functional training.

The Manager described this,

> *Some people have not even used a mouse or a computer...Training was provided for 2-3 days mainly for users, mainly technical. We did not know what is inside the*

package...so basically all of us were learning. In 1999 ERP was new even to the vendor's team. People did not know much so all of us were trying to learn by trial and error.

6.9.3.9 Other key success factors

Users have not supported the ERP implementation in this firm. The Assistant Manager however suggested users should support the developer and co-operation between them is very important for ERP to be successfully implemented.

Users do not accept new things. This is a problem everywhere. 60 per cent of ERPs have a problematic implementation. ...Users should share their requirements in advance so developers can be prepared, because user feedback is definitely important to developers.

6.9.4 Summary

The following points can be highlighted in this case:

a. The integration of the business processes across the firm had not been realised through ERP because of the incomplete ERP system implementation.
b. The top management involvement in the ERP project was very limited. The project was driven by the IT Department because it was felt that ERP implementation is a technical project and the IT Department can handle the implementation on their own.
c. The firm lacked any formal ERP team, with work being allocated according to the availability of staff. Due to this, project activities were not completed by the staff as they knew they would only have to work on the ERP project for few hours or days.
d. Very limited project planning was conducted.
e. Users' resistance was present throughout the implementation because of the lack of effective communication between top management, Managers and users.

The key implementation success factors are summarised in table 6.27.

Table 6.27 - Summary of factors related to successful ERP implementation

Emergence of idea: internal or external	Internal: IT department
Reasons for implementing ERP	To solve Y2K crisis
Top management support	Support was received but their involvement was not apparent
ERP team	Inconsistent team members-not dedicated to project
Project planning	Found to be lacking
Process of vendor selection	Based mainly on cost
Communication	Efforts were not made to communicate effectively
BPR and customisation	Over-customisation
Training process	Informal training sessions
Implementation strategy	Step-by-step
Users' feedback	Not taken frequently
Users' resistance	Most of the users resisted

Source - Compiled by the author

6.10 Summary

6.10.1 Influence of industry sector

Whilst a comparison of adoption and implementation of ERP systems across different industry sectors was not a focus of the research, the research design included a number of firms from the same manufacturing industries, as well as firms from different industries. This allowed some tentative insights into the role of industry sector on adoption. This chapter demonstrates that ERP has been implemented successfully in firms 1, 2, 3, 4, 5 and 6, which includes firms from the same sector (firms 1, 2 and 3 all make and assemble car parts) and firms from different sectors (firm 4 manufactures homoeopathic products; firm 5 is in clothing; and firm 6 is in cable manufacturing). This suggests that firms from a range

of industries can implement ERP successfully. Interestingly, all three firms included in the study that produce and assemble car parts were successful in their implementations. These firms also supplied parts to larger manufacturers with whom they worked closely (for example firm 1 was situated close to its main customer). ERP adoption and use is common in larger auto manufacturers (Markus *et al.*, 2000), and so, as will be discussed further in the next section, the medium sized firms may have benefited from the experience or influence of their customers' use of ERP.

In contrast, firms 7, 8 and 9 were not successful in ERP implementation. Of these, firm 7, like firm 5, is in clothing manufacturing but firms 8 and 9 are in the cable and sponge iron manufacturing sector respectively. Again, this suggests that firms from a range of industry sectors can be unsuccessful in their ERP implementations. Comparing across the successful and unsuccessful firms, both firms 5 and 7 produced clothing and firms 6 and 8 manufactured cables. In both cases, one of these firms was successful and the other unsuccessful, suggesting it is not inherent characteristics of these industries that determine success, but the approach and resources of the firms that determine success. This finding is consistent with the resource based view of the firm discussed in chapter 4 (Barney, 1986; Grant, 1991; Wernerfelt, 1984). Interestingly, interviewees from the unsuccessful firms cited the complexity of their industries or manufacturing processes as a contributing factor to their difficulties. For example, staff in firm 8 cited the number of permutations in cable making as a difficulty in specifying material quantities in their ERP manufacturing module. However, the successful implementation by firm 6 in the same industry shows that it is possible to implement and use ERP systems in this industry.

Whilst this study provides some possible suggestions of the role of industry sector on ERP implementation, it is recognised that further studies need to be carried out to provide empirical evidence and to understand the influence of different manufacturing sectors.

6.10.2 Role of external pressures to adopt ERP

Pressure on medium-sized firms in India to adopt ERP systems may come from a number of sources. The most evident is pressure from ERP vendors - international ERP vendors competing to enter the Indian market and both local and international vendors trying to move into the SME sector. For Indian medium-sized firms that are part of a larger international or Indian company, their parent company may require them to adopt such systems. In addition, powerful customers may require their suppliers to adopt certain ways of working that require the use of ERP systems. However, even if firms are not explicitly required to adopt such systems, they may be influenced to adopt and implement ERP through competitive pressures from other advanced Indian firms. Thus, external pressures come from owners, competitors, powerful suppliers and vendors as well as from many different types of advisors. Added to this, there are also often strong internal pressures driven by the competitive need to improve the efficiency of internal operations (Raymond *et al.*, 2007; Lee and Myers 2004).

The only firm that described an explicit requirement to adopt ERP was firm 4. The interviewees in firm 4 indicated that ERP was adopted in their firm due to the external pressures from the parent company in Germany. This parent company stressed the importance of ERP systems and commenced ERP implementation process in firm 4. Though the pressure was from the parent company, top management in firm 4 also contributed significantly in the adoption and implementation process. This suggests that even though SMEs can face external pressures from their parent companies, the involvement and contribution of their top management is also important in successful implementation.

Whilst firms 1, 2, 3 and 6 were not expressly required to adopt ERP, the interviewees described their adoption being influenced by outside parties, as well as being driven by the

desire to improve internal operations. For example, as mentioned in chapter 6, top management in firms 1, 2 and 6 had prior knowledge of the operation of ERP systems from outside sources, in particular that they can enhance production quality and supply chain integration. In firm 3, the Chairman and Managing Director (CMD) was also a board member of one company of their size who were in the process of ERP implementation. The CMD described how he witnessed the improvements in this firm achieved from the ERP system.

Firm 9, one of the unsuccessful firms, was also influenced by external parties to adopt their ERP system. As described in chapter 5, the firm of vendors suggested the adoption and implementation of an ERP system would address the Y2K problems with their existing systems.

Interestingly whilst the firms those were successful with their ERP implementations tended to be influenced by external parties, two of the unsuccessful firms did not describe external pressures or influences on their adoption of ERP. Interviewees in firms 7 and 8 reported that ERP was initiated to streamline the business processes and hence to increase the productivity of their firms.

Similarly to the section above that discusses the influence of industry sector on ERP implementation, this study did not focus on the pressures or influences faced by firms to adopt ERP systems and in the impact of those on implementation success. However, the varying influences on adoption witnessed across the case studies allow some tentative observations to be made that can be further explored in future research. All the firms that were successful had a degree of external influence or pressure on their adoption, and that influence included some ability to learn from the influencing party. This suggests that these firms increased their absorptive capacity from these external parties. In contrast, firms 7 and 8, which were unsuccessful with their implementations, did not draw on the experience

of outside parties. Whilst firm 9, was influenced by an outside party, it was still not successful, suggesting that the vendor that advised them was not sufficiently experienced and that the knowledge of external parties is not sufficient for implementation success alone, rather, at least some of the other elements shown in figure 4.5 in chapter 4, must also be present.

6.10.3 Conclusion

To address the first research question 'how do ERP implementation strategies influence ERP implementation success in firms, implementation strategies in nine cases were studied. In cases 1, 2, 3, 4 and 6 ERP has been implemented through a big bang strategy. In contrast, in firms 5, 7, 8 and 9, a step-by-step ERP implementation strategy was chosen. Of these, firm 8 had gone for an in-house implementation process. The next chapter (chapter 7) further discusses and analyses why the firms have chosen a big bang or step-by-step strategy and how these have influenced ERP implementation success in firms.

To address the second research question, 'how do the different factors that are critical to the successful implementation of ERP interact in order to achieve success', this chapter looked at key factors identified in the literature: top management support, communication, project planning, vendor selection process, business process re-engineering, customisation, training resources and characteristics of ERP team members in each of the nine cases. How these factors independently and in combination influenced ERP implementation success in the cases are analysed in the next chapter.

This chapter further discussed the prior knowledge of top management, the ERP implementation team, the firms' existing and improved technological skills and business understanding to explore the absorptive capacity of the case study firms. An analysis and discussion of absorptive capacity components is presented in following chapter in order to

understand if and how absorptive capacity influences ERP implementation success (third research question).

Thus, this chapter presented an overview of the nine cases selected for the study. The next chapter presents the cross case and group analysis of background information, ERP implementation process, level of ERP implementation success and CSFs based upon the information gathered from multiple respondents in each firm.

CHAPTER 7: ANALYSIS AND DISCUSSION

7.1 Introduction

In this chapter cross-case and group analysis is undertaken on the nine case studies. The objectives of this chapter are to explore the influence of CSFs, firm's internal resources and firm's absorptive capacity on the ERP implementation process.

The theoretical perspectives discussed in chapter 4 are used to guide the analysis of the data. Based on the cross-case analysis, the nine cases are categorized into three groups according to the different assessed levels of ERP implementation success and failure. These three groups named as group A, group B and group C are formed to compare and analyse the ERP implementation process in the firms.

Section 7.2 compares the company background of all nine case study firms. Section 7.3 discusses the ERP implementation strategies adopted by each of the case study firms. The level of ERP implementation success in each firm is analysed in section 7.4. A comparison across the nine cases and between groups A, B and C is discussed in section 7.5. The level of absorptive capacity in all nine case study firms is discussed in section 7.6. The chapter is summarised in section 7.7.

7.2 Company background

Firm 1 was established in 1985 and produces seating systems. It employs about 300 full time staff and had the annual turnover of around 2.0 billion INR. Firm 2 was established in 1992 and manufactures automobile interiors. It has about 200 full time employees with a turnover of 2.0 billion INR. Firm 3 was established in 1985. It employs about 150 employees, manufactures steering systems and has a turnover of 2.5 billion INR. Firm 4, established in 1997, has about 300 full time employees and an annual turnover of about 4.0

billion INR. It manufactures homoeopathic products. Established in 1992, firm 5 is in the retailing and manufacturing of branded garments. The enterprise has 125 employees and 1.0 billion INR turnover. Firm 6 has been in the business of cable manufacturing since 1970. The company has 4.0 billion INR turnover and about 300 employees. Firm 7 manufactures designer wear products that are exported to USA, Canada and Japan. The firm was established in 1997, employs about full time 200 people and has a turnover of 1.5 billion INR. Firm 8, established in 1954, manufactures telecommunication and power cables and employs about 180 people full time. Firm 9 established in 1985, is in the business of sponge iron manufacturing and employs about 270 people full time. The summary of firms' year of establishment, annual turnover and number of employees is presented in table 7.1.

Table 7.1 - Firms' background

	Establishment year	**Number of employees**	**Annual turnover**			**Industry (manufacturing)**
			billion INR	million GBP approx.		
Firm 1	1985	300	2	30		Car parts
Firm 2	1992	200	2	30		Car parts
Firm 3	1985	150	2.5	37.5		Car parts
Firm 4	1997	300	4.0	60		Medicines
Firm 5	1992	125	1.0	15		Clothing
Firm 6	1970	300	4.0	60		Cable
Firm 7	1997	200	1.5	21.5		Clothing
Firm 8	1954	180	1.2	17		Cable
Firm 9	1985	270	1.75	26		Sponge iron

Source - Compiled by the author

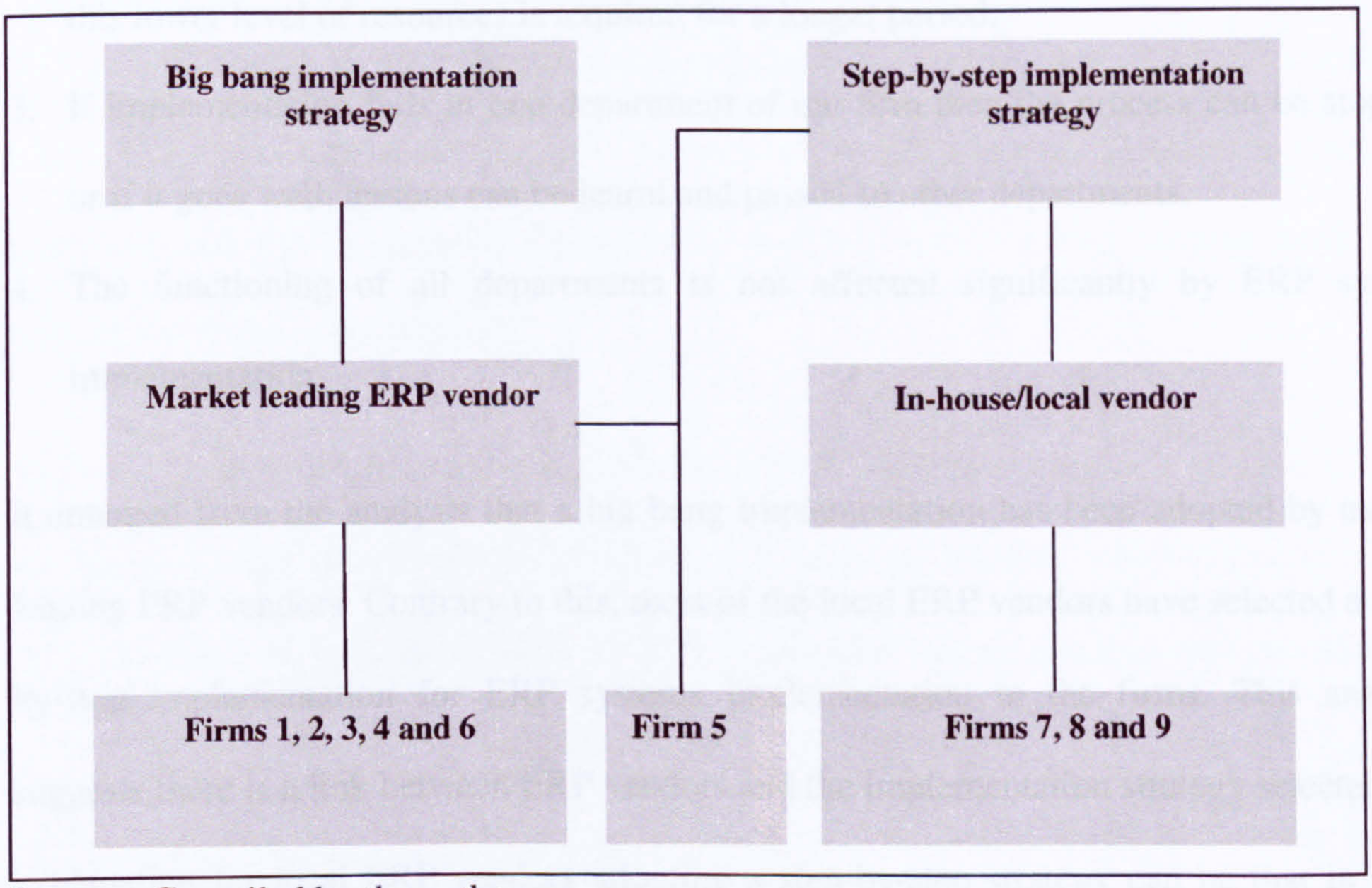
The firms in the study have been in business for a wide range of durations from 54 years (firm 8) to just 11 years (firms 4 and 7). The firms 1, 4 and 6 are largest with respect of staff numbers and the smallest firm is 5 with 125 staff members. Firms 4 and 6 has highest turnover of about 4 billion INR (60 million GBP approximately) and firm 5 have lowest

turnover of about 1 billion INR (15 million GBP approximately). Whilst the sample consists of a range of manufacturing sectors, table 7.1 shows that there are also a number of firms drawn from the same sectors. For example, firms 1, 2 and 3 all make and assemble car parts whilst firms 6 and 8 are in the cable manufacturing sector and firms 5 and 7 are in clothing manufacturing. The inclusion of firms from the same sector allows issues and factors that are specific to certain industries to be explored and compared to firms in other industries.

7.3 ERP implementation strategy

In cases 1, 2, 3, 4 and 6 ERP has been implemented through a big bang strategy. In contrast, in firms 5, 7, 8 and 9, a step-by-step ERP implementation strategy was chosen. Of these, firm 8 had gone for in-house implementation process (figure 7.1).

Figure 7.1 - Implementation strategy adopted by firms



Source - Compiled by the author

Firms 1, 2, 3, 4 and 6 have adopted a big bang implementation strategy mainly for the following two reasons:

1. All the employees of the organisation can be made aware of the ERP implementation from the beginning of implementation.
2. ERP team members can be dedicated to the implementation. This might not be possible in step-by-step strategy due to its long implementation period and team members will have to be changed as implementation progresses.

Firms 5, 7, 8, and 9 stated a preference for a step-by-step implementation approach for the following reasons:

1. Step-by-step implementation is spread over long period of time as compared to big bang approach, therefore, the organisations gets more time to understand the implementation process.
2. Due to the scarcity of financial and human resources, the step-by-step approach is favored since it requires a lower level of resource than a big bang approach. However, this lower level of resources is required for a longer period.
3. If implementation fails in one department of the firm then the process can be stopped or if it goes well, lessons can be learnt and passed to other departments.
4. The functioning of all departments is not affected significantly by ERP system implementation.

It emerged from the analysis that a big bang implementation has been adopted by market leading ERP vendors. Contrary to this, most of the local ERP vendors have selected a step-by-step implementation for ERP systems implementation in the firms. This analysis suggests there is a link between ERP vendors and the implementation strategy selected. An explanation for local ERP vendors adopting a step-by-step strategy can be that in India there is an enormous growth of local ERP vendors in recent years. However, some of these vendors might not possess enough technical skills, management skills and resources required for big bang ERP implementations. Therefore, local vendors may show a

preference for step-by-step ERP implementation for their own reasons and not necessarily for those of their client.

7.4 Level of ERP implementation success

Firms 1, 2, 3 and 4 completed their ERP implementation within 6-10 months. In all these cases, the time period and implementation costs did not exceed the initial planned time and costs. None of these firms were using any manual or legacy systems for the operation of their production units after the ERP implementation. This suggests business was fully managed through ERP systems after implementation.

According to the ERP Implementation Manager in firm 1, the ERP implementation can be considered successful because the ERP implementation was completed within the planned time schedule. Further, the firm has derived identifiable operational benefits due to the ERP system (for example, the seating units are delivered to the manufacturing assembly line on a JIT basis). In addition, there was an identifiable improvement in decision making, planning, strategic benefits (the JIT delivery of products led to business growth and improved external linkages with customers) and the wider learning process about ERP technology in the organisation.

In firms 2 and 3, the interviewees considered ERP implementation as a success because they were getting the expected strategic and operational benefits which influenced their initial decision to implement ERP. In firm 2, the ERP implementation was considered a success because the firm manufactures four different products with over 50 different models and through the ERP implementation, automation and an integration of the majority of business processes in production units has been made possible. This has resulted in real time information being available across the enterprise that helps in informed and fast decision making, the improved production cycle of automobiles interior products, reduced inventory levels and improved customer relationship.

Similarly in firm 3, the ERP implementation process was completed successfully and the firm was deriving benefits that were considered important by the case study participants. The ERP systems have helped the firm in improving their production of steering gears through integrated information flow, real time information generation and standardised production processes. Further, strategic benefits like enhanced external relationships both with suppliers and customers have been observed after the ERP implementation.

In addition to the benefits achieved, firm 4 considered their ERP implementation a success from the viewpoint of users, management and business operations. Firm 4 manufactures homeopathic medicines and through their ERP they can access real time information through a centralised database. For example, they can track batch number of medicines, information on raw materials, manufacturing details, purchasing details and dispatch details. So in this way the status of products, payment and order details are made available to the firm immediately. These are some of the benefits that has led to improved business operations. In terms of benefits derived by management, access to user friendly reports any time helps management to improve planning processes and make better decisions. In terms of users' satisfaction also, in firm 4, the ERP implementation was considered a success. Users' satisfaction was high in particular at the later stages of ERP implementation because of improved performance due to the reduction of errors in filling customer orders through the elimination of multiple data entry system.

In comparison to the above mentioned firms, firm 5 took about 15 months and firm 6 took about 2 years to complete their ERP implementation. Though the project has taken longer than planned for both firms, both firms considered their ERP implementation successful. In firm 5, the ERP implementation is providing benefits to the firm consistent with those anticipated at the beginning of the project. Firm 5 manufactures branded garments and

through the ERP implementation, the control of inventory and the product range has become easier due to the centralised database and the integration of business activities across the manufacturing factory and the head office.

The firm 6 manufactures different varieties of cables and each kind of cable has different production specifications. Through their ERP implementation, the firm has achieved improved business performance due to reduced production cycles, a smoother flow of information and integration of applications across all functions and locations.

In firms 7, 8 and 9 ERP implementation has not been successful due to the incomplete implementation process, little users' satisfaction and almost no benefits derived. All the interviewees confirmed that implementation has not been completed on time and within budget as planned in these firms. In firm 7, 90 per cent of users initially resisted the implementation of ERP in the firm because they felt their job security would be threatened if ERP was implemented successfully.

Both the Director and the Head of IT in firm 8 agreed that complete success has not been achieved so far because the project is behind schedule, over budget and has not been completed. Similarly in firm 9, integration of the business processes across the enterprise was not achieved through ERP because of the incomplete implementation of ERP modules.

As discussed in sub-section 3.7.1 (chapter 4), the four major criteria considered as measures of ERP implementation success are:

1. implementation duration;
2. budget;
3. benefits to company's performance;
4. users' satisfaction.

The foregoing discussion indicates firms 1, 2, 3 and 4 have, according to the success measures adopted in this study, successfully implemented ERP system in their firms. Furthermore, though firms 5 and 6 could not implement ERP in line with their planned time schedule they considered the eventual implementation to have been a success because the firms were able to identify performance advantages directly attributable to ERP. The analysis of firms 7, 8 and 9 suggests that implementation has not been successfully completed within scheduled time frame, within the planned budget and firms have not achieved the expected benefits (table 7. 2).

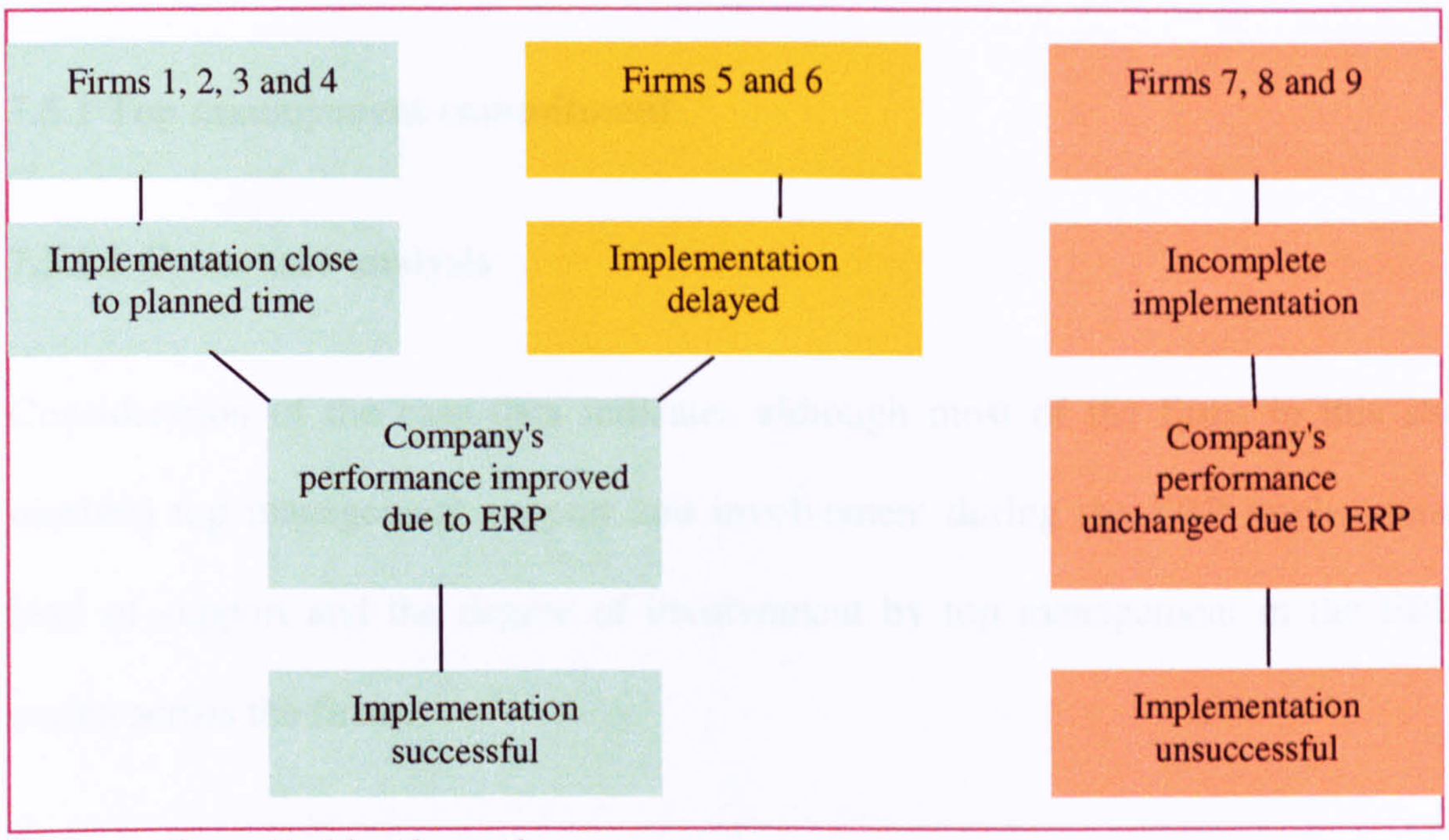
Table 7.2 - Implementation success indicators

	Time schedule	Financial plan (budget)	ERP benefits	Users	ERP system implementation
Firm 1	Maintained	Maintained	Received	Highly satisfied	Successful implementation
Firms 2 and 3	Maintained	Maintained	Received	Satisfied	Successful implementation
Firm 4	Maintained	Maintained	Received	Highly satisfied	Successful implementation
Firms 5 and 6	Delayed	Exceeded largely	Received	Satisfied	Successful implementation
Firms 7, 8 and 9	Unable to complete	Exceeded largely	Not achieved	Users' resistance observed	Unsuccessful implementation

Source - Compiled by the author

Based on table 7.2 and the analysis of cases indicates except firms 7, 8 and 9 all other firms have implemented ERP successfully and have derived various ERP benefits (figure 7.2).

Figure 7.2 - ERP implementation success level in firms



Source - Compiled by the author

The analysis in the above sections indicates Indian medium sized manufacturing firms 1, 2, 3 and 4 show similarity in the ERP implementation process and in achieving ERP benefits. Therefore, all these firms are put together in group A. Firms 5 and 6 have faced constraints and had to overcome some problems before experiencing ERP implementation success in their firms. Both these firms are placed in group B. The last three firms 7, 8 and 9 faced constraints during implementation process and found ERP implementation success difficult to obtain and are grouped together in group C.

In the next section, identified CSFs are analysed across the nine firms. Then, CSFs are compared and discussed within and between groups A, B and C based on how the firms' individual resources or complementarity of resources can impact on the implementation success of ERP systems.

7.5 Critical success factors

7.5.1 Top management commitment

7.5.1.1 Cross-case analysis

Consideration of the case data indicates although most of the firms in this study have received top management support and involvement during the ERP implementation, the kind of support and the degree of involvement by top management in the ERP project varied across the firms.

In firm 1, top management showed interest and involvement in important project activities such as the vendor selection process and reassigning work of the ERP team members. Further, emerging ERP project related issues were given priority by top management throughout the implementation process due to their ability to act quickly. This helped completion of the ERP project tasks on schedule.

Moreover, top management ensured employees support during the implementation period by providing the resources for the relevant training and education in the concept of ERP. The Chairman of firm 1 was himself present in presentations and the doubts and issues raised by the staff were answered in these presentations. Top management assisted in making staff and end-users confident that ERP deployment was a must for the organisation's growth and to increase their work efficiency. This illustrates top management's understanding that employees' support is crucial for the implementation success. Top management involvement resulted in ensuring almost no users' resistance from staff.

Similarly in firm 2, top management provided business leadership and supported the IT staff in all the phases of the ERP implementation. One of the reasons for their support was a keen interest to adopt IT solutions that can enhance the efficiency of their production

process. Top management had a good understanding of ERP systems and its importance to their firm. Financial resources were made available by them for a well-known vendor and extensive ERP training. The Chief Information Officer, who acted as a project champion, had the opinion that to be successful, ERP implementation should always be a top down approach.

The Head of IT in firm 3 indicated top management was engaged in most of the ERP project related activities throughout the project to provide leadership and project direction. For instance they were involved in planning project deadlines, choosing the implementation partner, building up a team and communicating with other departments about expected ERP benefits. The Chairman and Managing Director himself possessed knowledge of ERP implementation and how top management play an important role in making it successful. According to him top management support is a must and has to be present to make ERP successful, otherwise employees may not show an interest which may lead to implementation failure. He emphasised the need for team effort and stated that management involvement encouraged team working.

> *Most of the time I was present in the meetings to discuss the project progress in general and any issues in particular...without our support it is difficult for the IT Department to do it by themselves. It is something where everyone has to be involved (Chairman and Managing Director).*

Similarly to firms 1, 2 and 3, firm 4 had received full support from the top management during their ERP implementation.

Further, top management has also been actively involved in minimising the users' resistance in firm 4 because they knew users' support is crucial for the ERP implementation success in their firm.

In firm 5, top management participated in the selection of the ERP vendor, project planning and in the allocation of resources. Top management's most crucial role in the entire ERP project was assisting in increasing the level of ERP acceptance in the company. Both the IT Manager and the Manager-Systems knew that the ERP implementation requires total commitment from the management rather than leaving the project to the IT department.

In firm 6, according to the General Manager (finance), top management have helped in providing additional manpower, extra finance, project planning and vendor selection. However, according to the Assistant Manager (IT), top management involvement with the project reduced over time. After 3-4 months they began to consider ERP project more of an IT project rather than business project.

The top management approach towards the ERP implementation in their firms was found to be dissimilar in firms 7, 8 and 9 compared to the other firms. In firm 7, IT staff played the main role in the implementation process. Though top management showed willingness to implement the ERP, their involvement in the crucial ERP implementation project activities (for example, the vendor selection process and assisting in increasing users' acceptance) was found to be lacking. It was considered an IT project throughout the implementation process rather than strategic re-organisation of the firms' business processes and systems. This shows top management had not realised the importance of their role in the ERP implementation project activities. For instance, they did not recognise their role in suitable vendor selection and how the selection of the wrong vendor could be one of the critical factors leading to implementation failure. Thus in firm 7, the ERP team lacked clear project direction from top management. Also, top management's lack of knowledge of ERP implementation could not add value to the knowledge of the ERP team.

The Head of IT and the Director in firm 8 expected the ERP project to be implemented by the IT staff. The Director of the firm himself stated that their involvement was limited and the Head of IT was mainly responsible for the ERP implementation. Thus, top management involvement in vendor selection, developing training strategies, formation of the ERP team and project planning was found to be lacking.

Regarding the role of the management in the previous unsuccessful ERP implementation, the Head of IT (firm 8) expressed his views,

> *Management has nothing to do with the failure because the IT people were doing most things...*

The above statement clearly shows that even in the earlier unsuccessful implementation, top management's role was limited to financial matters and they wanted it to be successful because they had paid the vendor, rather than showing an interest in the ERP benefits that the firm could achieve from successful ERP implementation. This also shows even after the earlier failed ERP implementation, top management and the ERP Implementation Manager did not realise the likely negative impact of a lack of top management participation in the ERP implementation.

Similarly to firms 7 and 8, in firm 9, top management were involved in the decision to implement, but did not participate significantly in the implementation process. The case study participants in firm 9 agreed that top management involvement in the ERP project was very limited. The ERP project was driven by the IT department. The understanding of the importance of top management involvement in the ERP project was found to be lacking in the Manager and the Assistant Manager as both of them felt that ERP implementation is a technical matter and it is IT personnel's responsibility. In their views, top management's role is limited to providing the financial support for the project and the IT department can handle the implementation on their own.

Both the top management and the ERP Implementation Manager in firms 7, 8 and 9 have treated the ERP project as more of a technical project that can be handled by the IT team alone. This demonstrates their lack of understanding of the importance of top management commitment and a cross-functional team for implementation success. The specific role played by top management in ERP systems implementation in the firms can be seen in table 7.3. This table indicates top management involvement in most of the important ERP project activities in firms 1, 2, 3 and 4 as compared to reduced management involvement in cases 5, 6, 7, 8 and 9.

Table 7.3 - Top management roles in ERP project activities

	Top management roles in ERP project activities							
	Vendor selection process	**Project planning**	**Allocation of resources**	**Reassign work to ERP team members**	**Immediate attention to ERP project related issues**	**Reducing users' resistance**	**Frequency of meetings with implementation team**	**Provided leadership /direction**
Firm 1	*	*	*	*	*	*	Regular	*
Firm 2	*		*		*		Regular	*
Firm 3	*	*		*	*		Regular	*
Firm 4	*	*	*	*		*	Regular	*
Firm 5	*	*				*	Regular initially	Initially
Firm 6	*	*	*				Regular initially	Initially
Firm 7							Few	
Firm 8			*				Few	
Firm 9			*				Few	

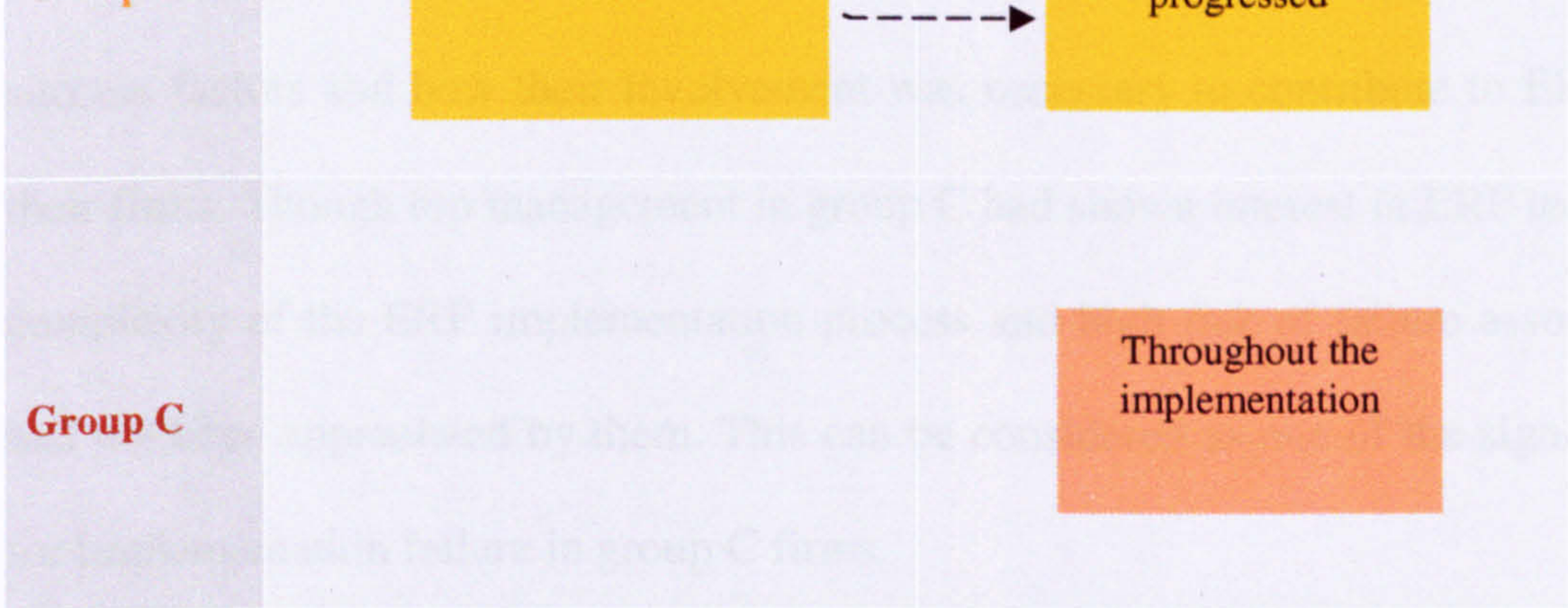
*** Evidence of top management involvement in project activities**

Source - Compiled by the author

7.5.1.2 Group analysis

Based on above cross-case analysis and table 7.3, the level of top management involvement in ERP project implementation in groups A, B and C is shown in figure 7.3.

Figure 7.3 - Top management involvement in ERP implementation process in firms



Source - Compiled by the author

The foregoing discussion suggests that in Group A, top management commitment, demonstrated by their involvement in key activities such as project planning, vendor selection as well as the effective allocation of human and financial resources, contributed to the firms' capability to implement ERP successfully. They recognised that ERP implementation is a complex process and top management commitment is a crucial success factor for making implementation successful. Therefore, their full support and involvement was observed throughout the implementation.

Firms in group B were supported by top management during the first 1-3 months but during the later months of implementation, top management interest in the ERP implementation was found to be declining. This slowed progress on some of the critical ERP project activities because the leadership, decision-making and project direction were not available to the ERP Implementation Manager and implementation team. Thus, the lack of continuous support from top management can be seen as one of the factors contributing to implementation delay in group B firms.

In contrast, in group C, the ERP implementation was considered as an IT project rather than as a business project from its inception. So, top management left the ERP project responsibilities to the IT team. Top management involvement in important implementation processes, for example, in the vendor selection process and project planning, was found to be nearly absent. This demonstrates their lack of knowledge about ERP implementation success factors and how their involvement was necessary to contribute to ERP success in their firms. Though top management in group C had shown interest in ERP technology, the complexity of the ERP implementation process and high risk of failure associated with it had not been appreciated by them. This can be considered as one of the significant reason for implementation failure in group C firms.

This analysis also identifies certain firms internal resources related in particular to top management that were available and deployed by group A firms rather than by group B and group C firms that assisted in successful implementation process. These resources were:

1. Top management commitment (Powell and Dent-Micallef, 1997) towards successful ERP implementation.
2. Knowledge of top management (Barney, 1991) of the ERP implementation process.

3. Knowledge and experience of project champions (Barney, 1991) in suitable vendor selection process, BPR, ERP implementation strategies, training process and the importance of the cross-functional dedicated ERP team.
4. Ability to act quickly (Bharadwaj, 2000) to take decisions related to the ERP project to keep project tasks completion on schedule.
5. Problem solving orientation (Ross *et al.*, 1996) to manage the emerging challenges.

Though studies on ERP CSFs from the perspectives of RBV are lacking in the existing literature, evidence from the cases confirms the findings of previous literature on IT implementation more generally. Top management commitment has been considered as a valuable human resource for IT implementation success. For example in earlier studies, Keen (1993) identified the resources, CEO commitment to IT as necessary for successful IT implementation. CEO commitment improves IT success by making resources available for implementation, integrating IT with business strategy and processes, and by ensuring continuity in IT investments for a period of time (Kettinger *et al.*, 1994). Consistent to this, this study finds that firms with implementation success have seen management participation in project planning, vendor selection and training investment.

This analysis confirms that top management involvement and commitment is one of the key success factors for making implementation successful in medium sized Indian manufacturing firms. This finding is similar to the findings in extant ERP literature on CSFs in SMEs reported by Muscatello *et al.*, (2003), Lee and Molla (2006) and Plant and Willcocks (2007).

7.5.2 Project planning

7.5.2.1 Cross-case analysis

Project planning and ERP stakeholders' involvement in building a project plan differed in each firm. Firms 1, 3 and 4 actively involved their implementation partner (vendor's team) in project planning. However, in firm 2 the Chief Information Officer was mainly involved in detailed project planning. In firm 1, top management, the ERP Implementation Manager and the IT Manager developed a formal project planning structure in collaboration with each other. The Chairman and Managing Director was actively engaged in ERP planning activities in firm 3. Core ERP team members were involved in project planning activities in firm 4 (table 7.4).

Table 7.4 - ERP project stakeholders' contribution in project planning

	ERP stakeholders participation in ERP project planning activities				
	Top management	**IT Manager/ERP project implementation Manager**	**Core ERP team members**	**External implementation partners**	**End-users**
Firm 1	*	*		*	*
Firm 2		*		*	
Firm 3	*	*		*	
Firm 4	*	*	*	*	
Firm 5	*	*			
Firm 6	*	*			
Firm 7		*			
Firm 8		*			
Firm 9		*			

*** Indicates ERP stakeholders participation**

Source - Compiled by the author

Firm 1 planned most of the project activities that would have an impact on the project progress. Top management helped in assigning the project activities to the ERP team members and other individual members. Top management got involved in this planning so that resistance from personnel to accept their assigned duties would be minimised. To ensure on-time implementation, contingency plans were also made.

A similar kind of detailed planning was observed in the ERP implementation in firms 2, 3, 4, 5 and 6. The Chairman of firm 2 was familiar with project management techniques and had strong belief that detailed project planning had to be undertaken to finish ERP implementation within the scheduled time frame. He stressed a lack of knowledge by SMEs of project management techniques as one of the major reasons for their ERP implementation failures. Case study participants had knowledge that ERP is a time consuming, complex process and involves various project activities therefore scheduling of project tasks needs to be done beforehand. The main emphasis was on better resource planning and risk management analysis.

In firm 3, the Chairman and Managing Director and the Head of IT emphasized the importance of detailed project planning. ERP implementation was considered as a major business project, therefore project management techniques were considered necessary to accomplish successful ERP. In this firm, time frames for all the major project activities such as training programs, study of business processes were defined in consultation with the implementation partner. Then, monthly and weekly charts were also prepared to follow the ERP work progress. Further, the availability of and the requirement for resources like people, finance, time and infrastructure were fully investigated while developing the project plan. Accordingly work was assigned to team members and meeting schedules were planned beforehand.

The detailed project planning was a combined effort of the implementation partner and the core ERP team members in firm 4. However, the Executive (finance) stated that though planning was completed well before the implementation commenced, because they are different for every state, certain issues like government laws, excise duty for domestic and imported products, required attention during implementation.

Like firm 2, in firm 4, the focus was on the project activities and their timelines. However, firm 3, in addition to project activities, also planned for the availability and requirement of human and financial resources.

Similar to firm 4, a steering group, a project management group and an in-house ERP implementation team were all part of the project planning team in firm 5. A series of ERP project activities were identified, defined and tasks were assigned among project stakeholders. Attempts were also made to follow the timelines indicated in the project plan.

However, in firm 6, though detailed project planning facilitated the start of the project, after 2-3 months project timelines could not be followed. One of the reasons for not being able to follow the project timelines indicated by the interviewees in firm 6, was due to the unforeseen challenges that started emerging.

> *...all the details were available on paper but we were missing project direction, when challenges suddenly started to appear...it was mainly the IT department involved...(Hardware Engineer, firm 6).*

In contrast, firms 7, 8 and 9 prepared only a limited ERP project plan. In firm 7, the emphasis was on implementing the ERP software as soon as possible rather than conducting step-by-step planning. In firm 8, though the importance of project planning was recognised by the Head of IT, the time schedules and project plans could not always be followed. Postponing project activity by 5-6 days at a time became normal in this firm. The

main reasons for ERP tasks not being completed on time were due to resource weaknesses such as the unavailability of required staff and incomplete technical data availability on business processes. Previous implementation experience, ERP process knowledge and a clear understanding of how the business functions can help those involved in planning a project in recognising the issues that may hinder project progress.

In firm 9, the Manager and the Senior Executive noted that the ERP project was initiated to solve the Y2K problem. The purpose was to implement ERP as quickly as possible so there was insufficient time to undertake detailed project planning. Moreover, neither top management nor the local vendor provided enough information on the steps involved in ERP implementation. The Manager admitted it was his first implementation and he had no prior experience of any other IT technology implementation, so he himself was not aware of the level of project planning required.

Thus, it can be concluded that compared to firms 1, 2, 3, 4, 5 and 6, in firms 7, 8 and 9 very few ERP project activities were planned at the beginning of the ERP project. Table 7.5 summarises the ERP activities included in the project planning in the nine firms.

Table 7.5 - ERP project activities planned in firms

	Meeting schedules among ERP team members	Risk management analysis	Weekly and monthly charts on project progress	Allotted work to team members	Timeframes for project activities	Requirement of resources (people, finance and time)
Firm 1	*			*	*	*
Firm 2		*			*	*
Firm 3	*		*	*	*	*
Firm 4					*	*
Firm 5				*	*	
Firm 6	*			*	*	
Firm 7						
Firm 8					*	
Firm 9						

*** Evidence of well planned project activities**

Source - Compiled by the author

7.5.2.2 Group analysis

Group A firms have developed a formal project planning structure. However, project planning and ERP stakeholders' involvement in building up the project plan differed in each firm. For example firms 1, 3 and 4 actively involved their implementation partner in project planning. However, in firm 2 the Chief Information Officer was mainly involved in detailed project planning. In firm 1, top management, the ERP Implementation Manager and the IT Manager in co-ordination with each other developed a formal project planning structure. The Chairman and Managing Director was actively engaged in ERP planning activities in firm 3. Core ERP team members were involved in project planning activities in firm 4.

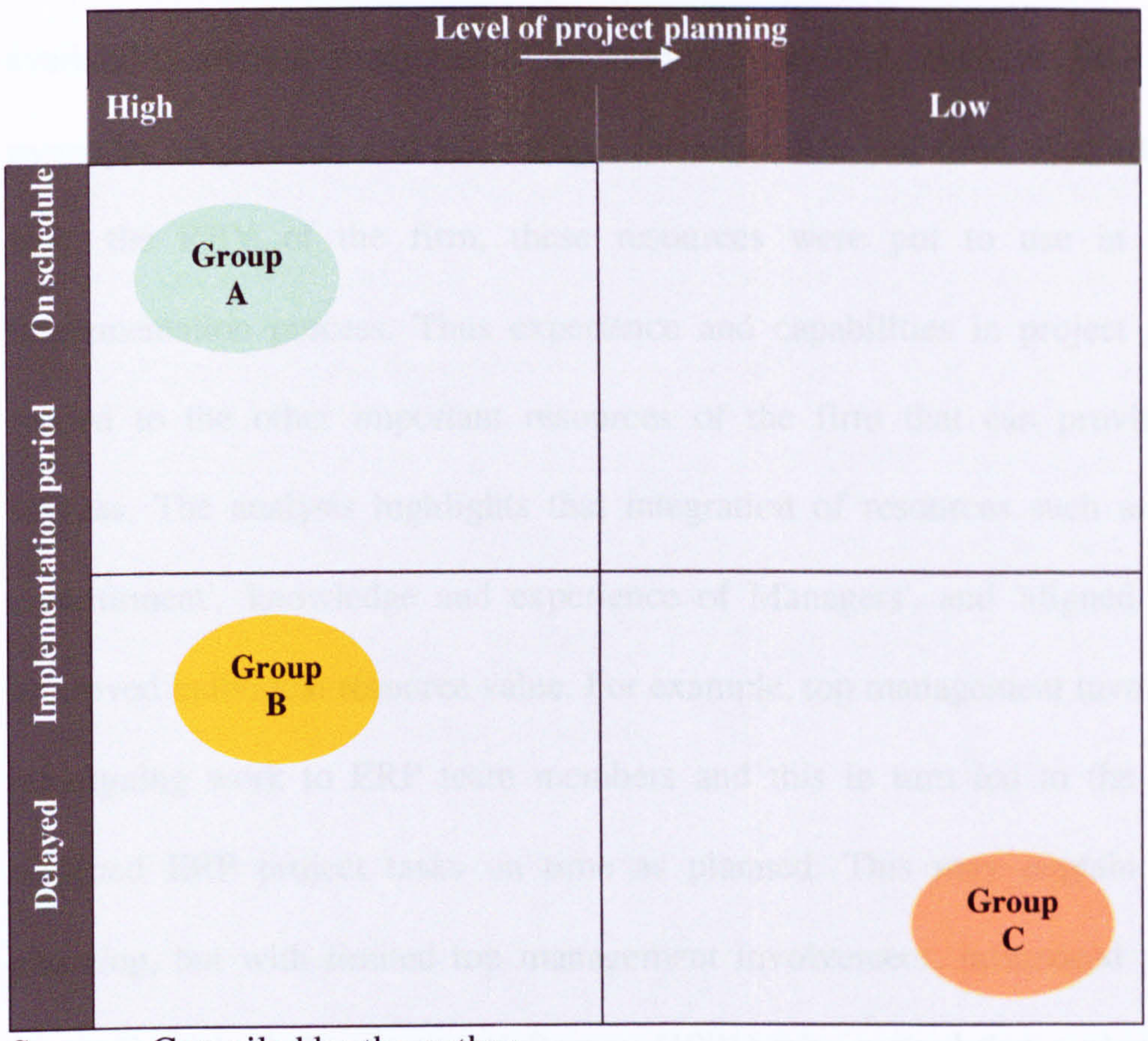
Similarly, the firms in group B planned their ERP implementation from the beginning, but the project schedule could not be followed. For example, in firm 6 though detailed project

planning facilitated the start of the project, after 2-3 months project timelines could not be followed. One of the reasons for this was the challenges that emerged during the ERP system implementation. The firm had to take time to solve these challenges and this led to the ERP implementation process falling behind schedule. Top management and the ERP Implementation Manager had not identified and therefore planned for the kind of challenges that appeared during the implementation process. One reason may be because the project planning lacked the input from the external implementation partner's team. External implementation partners have more experience of the ERP implementation process and the issues that may arise during implementation. Therefore their involvement in project planning may have helped the firm to be aware of these issues and develop a project plan accordingly.

In contrast to groups A and B, firms in group C undertook very little ERP project planning at the beginning of their ERP projects. Another difference noted between group C and the other two groups was that top management involvement in project planning was found to be absent in group C.

Figure 7.4 relates the degree of level of project planning observed in each group with the level of implementation success discussed in section 7.2. The figure suggest a relation between these two characteristics, with high levels of planning associated with high levels of success, suggesting this is an important factor in ERP implementation success.

Figure 7.4 - Level of ERP system project planning



Source - Compiled by the author

Project planning has also been considered as one of the key ERP success factors in earlier studies by Bancroft *et al.,* (1998), Al-Mudimigh *et al.,* (2001), Umble *et al.,*(2003), Nah *et al.,* (2003) in large sized firms and by Loh and Koh (2004) in SMEs. However, these studies have not explained what kinds of project activities that were planned by the firms and how they impact project progress.

This section of analysis also points out how the firms' internal resources associated with project planning were utilised by the firms 1, 2, 3, 4, 5 and 6 to develop the capability to implement ERP successfully. The identified firms' internal resources are:

1. Aligned IT planning (Ross *et al.*, 1996; Powell and Dent- Micallef, 1997)
2. Formal and informal planning (Barney, 1991)
3. Knowledge and experience of individual Managers and experience (Barney, 1991)

The project planning process helped the firms in groups A and B to understand the availability of and requirement for resources needed, such as ERP investment, team members' experience and knowledge, infrastructure and time. Accordingly, as expected from the RBV of the firm, these resources were put to use in the ERP systems implementation process. Thus experience and capabilities in project planning could be related to the other important resources of the firm that can provide implementation success. The analysis highlights that integration of resources such as 'top management commitment', 'knowledge and experience of Managers', and 'aligned IT planning' have improved individual resource value. For example, top management involvement assisted in reassigning work to ERP team members and this in turn led to the completion of the assigned ERP project tasks on time as planned. This may explain that good project planning, but with limited top management involvement, influenced project progress in group B. This finding supports Barney (1991) who argued that a planning system could bring advantages only if it 'enables a firm to recognise and exploit other of its resources, and some of these resources might be sources of sustained competitive advantage'.

7.5.3 Appropriate vendor selection

7.5.3.1 Cross-case analysis

Vendor selection was considered as the most important task in firm 1. Due to their earlier failed implementation by a local vendor, a decision was made to select an experienced well-known ERP vendor because they believed such a vendor can provide the opportunity to select software that best suited the way their business functioned. In this way extensive customisation can be avoided, which they saw as one of the causes for their earlier failed implementation. Three big ERP vendors (SAP, BAAN, and Oracle) were considered and BAAN was selected based on certain parameters such as a successful implementation

record and available solutions for the manufacturing sector especially for similar types of firm.

In firm 2, both the Chief Information Officer and management worked together to identify an ERP vendor with an ERP solution that would best suit the company's business practices. The ERP vendor selection was based on two criteria. Firstly, based on an analysis of the company's existing requirements as well as their future requirements for expansion and secondly on return of investments and payback periods. Importance was given to ERP solutions that best suited the company's processes, rather than going for an ERP solution that was running in another organisation.

The IT Manager and Chairman and Managing Director in firm 3 both attended seminars and presentations given by different ERP vendors. Based on these presentations, SAP, Oracle and BAAN were short listed. Oracle was selected mainly for two reasons. Firstly, because the firm already had Oracle in-house solutions and secondly, Oracle's ERP systems were running successfully in similar types of firms. Another reason indicated by Chairman and Managing Director was willingness of Oracle to work with them compared to SAP.

Similarly to firm 1, firm 4 chose its ERP vendor after comparing certain parameters across the market leaders. The six parameters on which different ERP solutions were compared included vendors' success rate, years of experience in the pharmaceutical industry, rating in the ERP market, time required for implementation and how much customisation would be required. Emphasis was placed on the knowledge of the vendor of pharmaceutical business processes.

The vendor selection process in firms 5 and 6 was dissimilar to that of firms 1, 2, 3 and 4. The Chairman of firm 5 took the initiative to select an ERP solution that was running

successfully in another company (not from a similar sector to that of firm 5) rather than based on a pre defined set of criteria.

Although firm 6 selected a well-known ERP vendor, BAAN, the reason was mainly because of the low cost compared to the cost of the ERP solutions offered by other market leaders. However, the choice of the wrong international version meant that the system did not easily integrate with the Indian localised version.

In firm 7, the main criterion for vendor selection was based on cost and simplicity of software rather than on suitability for the company's business processes.

The Advisor (technical) explained,

> *...we talked to SAP, we talked to Oracle, and found that the costings were high and they did not respond...we got this company which gives us personalised attention whenever we need it and at a low cost...*

In firm 8, an in-house based ERP solution was preferred because of their earlier experience of an unsuccessful implementation with a local vendor. Another reason for selecting an in-house ERP solution was that a standard ERP system from a global vendor may need customisation that might be expensive. According to the Head of IT,

> *...We did not go for SAP because management was not ready to spend that much...*

Similarly to firm 7, in firm 9, vendor selection was based predominantly on cost. Further, due to the Y2K crisis, the decision on the ERP vendor was taken in a hurry. The local vendor was selected primarily because of the low implementation cost.

Thus, it can be concluded from the above analysis that firms 1, 2, 3 and 4 evaluated several factors before making a decision on the ERP vendor when compared to firms 5, 6, 7, 8 and

9. Table 7.6 summarises the parameters considered during the vendor selection by the nine case study firms.

Table 7.6 - Parameters for vendor selection

	Parameters for vendor selection						
	Vendors' customers feedback considered	Cost	Vendors' prior successful ERP implementations	Experience in implementation	Running in other organisation	ERP fit with company's processes	Customisation requirements
Firm 1	*	*	*	*		*	
Firm 2		*	*			*	
Firm 3			*		*	*	
Firm 4	*		*	*		*	*
Firm 5					*		
Firm 6		*		*			
Firms 7, 8 and 9		*					

***Indicates parameters considered significantly**

Source - Compiled by the author

As seen in section 7.4, firms 1, 2, 3, 4, 5 and 6 have successful ERP implementations. All these firms have used well-known market leaders as their ERP vendors. This suggests that well-known ERP vendors have played significant role in successful implementation because of their wide international experience, understanding of business processes and availability of a range of ERP solutions to fit firms' business operations. Figure 7.5 shows the choice of vendors in nine cases and the implementation success in the case study firms.

9. Table 7.6 summarises the parameters considered during the vendor selection by the nine case study firms.

Table 7.6 - Parameters for vendor selection

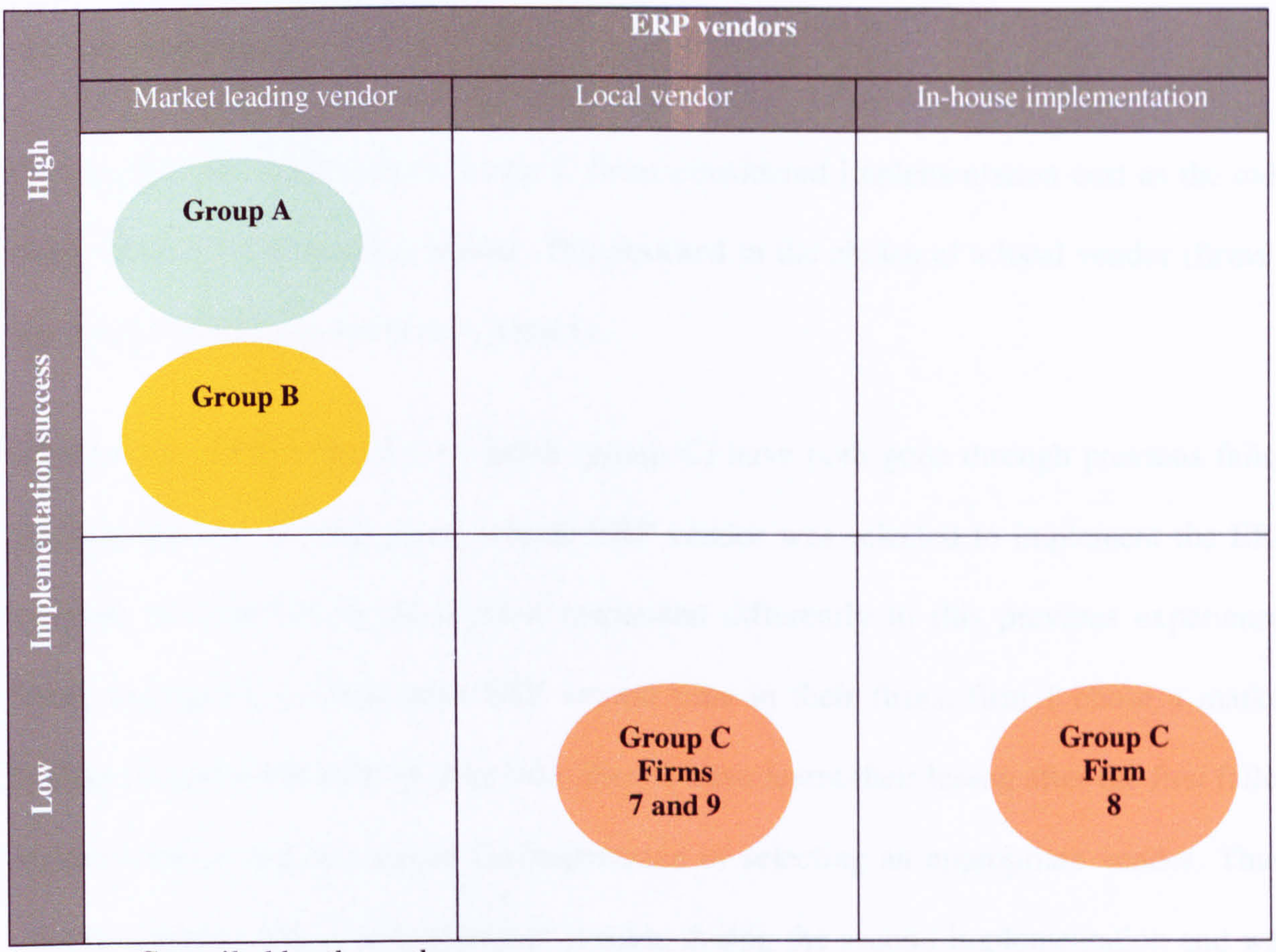
	Parameters for vendor selection						
	Vendors' customers feedback considered	Cost	Vendors' prior successful ERP implementations	Experience in implementation	Running in other organisation	ERP fit with company's processes	Customisation requirements
Firm 1	*	*	*	*		*	
Firm 2		*	*			*	
Firm 3			*		*	*	
Firm 4	*		*	*		*	*
Firm 5					*		
Firm 6		*		*			
Firms 7, 8 and 9		*					

***Indicates parameters considered significantly**

Source - Compiled by the author

As seen in section 7.4, firms 1, 2, 3, 4, 5 and 6 have successful ERP implementations. All these firms have used well-known market leaders as their ERP vendors. This suggests that well-known ERP vendors have played significant role in successful implementation because of their wide international experience, understanding of business processes and availability of a range of ERP solutions to fit firms' business operations. Figure 7.5 shows the choice of vendors in nine cases and the implementation success in the case study firms.

Figure 7.5 - Effect of vendor selection process on ERP implementation success



Source - Compiled by the author

7.5.3.2 Group analysis

Group A and group B firms considered ERP vendor selection as one of the most important success factor of their ERP implementations. Almost all the group A firms set the criteria for the selection of ERP vendors in their firms. For example in firm 4, emphasis was placed on the knowledge of the vendor about the pharmaceutical industry. The company has chosen to implement an ERP solution after comparing certain parameters with other ERP solutions provided by the market leaders. The six parameters on which different ERP solutions were compared included vendors' success rate, years of experience in the pharmaceutical industry, rating in the ERP market, time required for implementation and how much customisation would be required.

In group B the vendor selection process depended only on one or at most two factors (table 7.6). For instance, in firm 5 selection of a vendor was mainly based on the

recommendation of another company and firm 6 chose BAAN because of their competitive rates and experience.

Compared to the other groups, group C firms considered implementation cost as the only major criteria for selecting a vendor. This resulted in the choice of a local vendor (firms 7 and 9) and in-house development (firm 8).

Interestingly, firms 1 (group A) and 8 (group C) have both gone through previous failed implementations. In both cases, a local ERP vendor was selected to implement the ERP systems. However, these firms have responded differently to this previous experience. While attempting to implement ERP second time in their firms, firm 1 chose a market leading to implement ERP in their firm. Firm 1 have learnt their lesson after the first failed implementation and recognised the importance of selecting an appropriate vendor. Thus, vendor selection was a very extensive process during the second implementation and was based on clear criteria. The knowledge and experience possessed by the implementation team was wide and therefore they understood why their firm should not select a local vendor again. They also understood difficulties associated with customisation. Thus, the low level of customisation required was considered to be a very important factor leading to the selection of a market leading vendor. By contrast, in firm 8 neither top management nor the IT Manager looked at whether they had sufficient resources before making a decision on an in-house implementation. For example, lack of experienced IT implementation employees, incomplete infrastructure and lack of employees with sufficient knowledge of ERP technology were noted by the case study interviewees in this firm. The IT Manager himself was not trained in the implementation process.

Studies that include the details of the vendor selection process and parameters included in vendor selection processes are limited in the existing ERP literature. The vendor selection process is a key success factor but to make a decision on an appropriate vendor for ERP

implementation requires a firm to possess certain internal resources. The above analysis suggests that a firm needs to acquire the following internal resources in order to be able to select an appropriate vendor for their ERP implementation.

1. Understanding of business processes (Feeny and Willcocks, 1998; Ross *et al.*, 1996)
2. Knowledge assets (Bharadwaj, 2000)
3. Technical IT skills (Bharadwaj, 2000 and Mata *et al.*, 1995)
4. Top management (Keen, 1993) willingness to provide finance for suitable vendor based on clearly articulated parameters
5. Experienced Project Manager (Barney, 1991)

7.5.4 Business process re-engineering and customisation

7.5.4.1 Cross-case analysis

In firm 1, due to the earlier failed implementation experience, customisation was done to about only 10-20 per cent of the system. To avoid customisation, a BAAN ERP package that was similar to the firm's business processes was selected. Therefore, a few minor changes in business processes were made, rather making major changes to the software programmes.

Similarly, firm 2 spent time in selecting an appropriate ERP solution mainly to avoid ERP customisation. An effort was made in the firm to avoid customisation of the ERP software in order not to increase the implementation costs and time.

The Head of IT in firm 3 confirmed that based on Oracle's best business practices model, few changes were made in the firm's own business processes to avoid excessive customisation. Although, the firm did not want to change their own business processes, they did want to adopt some of the best practices provided by Oracle's ERP solution.

Another reason for minimum customisation in this firm was to avoid difficulty when upgrading of the system is needed in the future.

The Head of IT said,

> *...We looked at Oracle ERP processes and how are they different from ours...We did not really want to make too many changes in the business processes, but we made few changes as Oracle have best business practices in the world and we did not want to change that either. So we tried to balance both.*

The interviewees in firm 4 had knowledge of how customisation can lead to delay in implementation. The IT Manager in this firm stressed the importance of understanding the challenges of customisation. As he said,

> *Local vendors will tell you all good things about customisation...and in companies where the IT Manager or top management does not have enough knowledge, they will say OK to them and they will start implementing. Then they will know the impact of customisation on implementation...therefore people have to know what customisation is before going for it...*

Similarly to avoid increased costs and implementation time in firms 5 and 6, business process changes were carried out to fit the ERP software. It was considered a significant success factor by the case study participants because changes in the company processes can minimise the need for customisation. Therefore an in-depth study of existing business processes was conducted in order to identify the necessary changes to be made.

Both the IT Manager and Manager-Systems in firm 5 agreed that too much customisation of ERP systems negates the benefits of such systems.

The Manager-Systems stated,

Customisation can result in taking out all the best practices from the software...if there is too much customisation in the ERP, than there is no use of having that ERP running in your company.

The Assistant Manager (IT) in firm 6 expressed the opinion that it is very difficult to get an ERP package that can deliver all the requirements of any company. In this company, efforts were made to align the business processes to the software package but some customisation was still required due to the complex nature of the cable manufacturing process.

In contrast, in firms 7, 8 and 9 business process studies were not conducted and no modifications were made to how the business functioned to suit the ERP software. These firms were not sure of what changes could be made to their businesses so they preferred to make changes in the software as and when required.

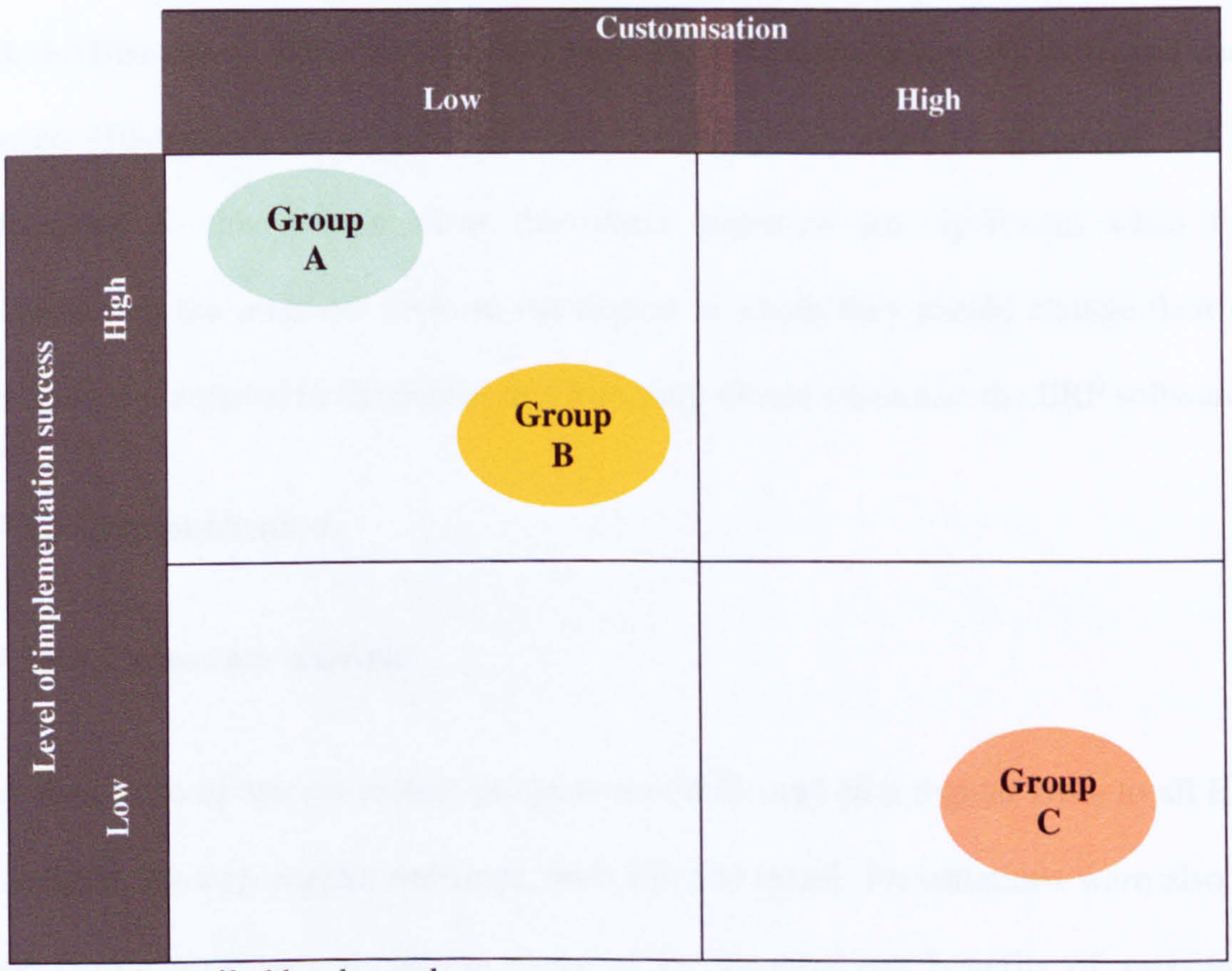
Firm 8 selected an in-house ERP implementation so that the system could be completely customised to the firm's requirements. As mentioned above, none of the three case study interviewees in firm 9 were aware of the term 'BPR'. When the meaning of the term was explained to them, they all agreed a business process study had not been conducted and processes were not modified because the purpose of the ERP implementation was to have a customised ERP system. The vendor being a small company and with only 1-2 years of experience did not have any standardised software for the company. Both the Manager and the Senior Executive noted that the ERP software was developed for their particular company so it was fully customised.

Thus, it can be concluded from the above cross-case analysis that firms 1, 2, 3, 4, 5 and 6 knew the importance of BPR and the impact of excessive customisation on the ERP implementation progress. Whereas, firms 7, 8 and 9 preferred to customise their ERP systems rather than change their business processes.

7.5.4.2 Group analysis

Figure 7.6 shows the relationship between the degree of customisation and the level of implementation success discussed previously. Firms in group A used the ERP implementation to transform their business processes and routines. They made necessary changes in their business processes to fit the ERP solution provided by the ERP vendor. The main purpose of doing this was to avoid excessive and costly customisation in ERP solutions and also gain the best practices embodied in the software. The ERP Implementation Managers of these firms were aware and recognised that too much customisation can increase both initial and on-going costs along with increased implementation duration. This knowledge and understanding of BPR and the impact of ERP solution customisation appear to have contributed to group A firms achieving successful ERP implementations (figure 7.6).

Figure 7.6 - Impact of customisation on ERP implementation success



Source - Compiled by the author

Similarly to avoid increased costs and implementation time, firms 5 and 6 in group B initially carried out changes in their business processes to fit the ERP software. A comprehensive study of existing business processes was conducted in order to identify the necessary changes to be made to fit the software. However, these firms had to undertake some customisation at the later stages due to the complexity of the business processes in clothes and cable manufacturing. This was one of the factors for the ERP implementation delay in these firms.

In contrast to groups A and B, in group C business process studies were not conducted and modifications were not made to their processes to suit the ERP software. These firms were not sure of what changes should be made to their processes so they preferred to make changes in the software as and when required.

In the previous studies integration of IT and business processes (Benjamin and Levinson, 1993), business understanding (Feeny and Willcocks, 1998; Ross *et al.*, 1996), technical IT skills (Bharadwaj, 2000; Feeny and Willcocks, 1998 and Ross *et al.*, 1996) and knowledge assets (Bharadwaj, 2000) have all been considered important IT resources. The findings discussed in this section show that these resources are significant when firms are considering the trade-off between the degree to which they should change their business processes compared to the degree to which they should customise the ERP software.

7.5.5 Communication

7.5.5.1 Cross-case analysis

In firm 1, an update on project progress was delivered on a regular basis to all ERP team members through regular meetings, web site and email. Presentations were also made to the firm's employees to inform them of the process and benefits of successful ERP implementation. Users were considered a significant part of the implementation process

and thus effective communication was maintained with the users throughout the ERP implementation through formal and informal meetings. They were involved in various project tasks to increase their interest in the implementation. This contributed to almost no user resistance to the ERP implementation.

Similarly, in firms 2, 3, 4 and 5 efforts were made to have effective communication with ERP stakeholders. A major concern during the project implementation was to keep employees updated on project progress and to keep continuous interaction between the implementation partners and the ERP in-house team. However, the mode of communication varied in each firm. Firms 3 and 5 used notice boards, leaflets, emails, monthly newsletters and meetings. In contrast, firms 2, 4 and 6 mainly discussed project activities and progress at regular meetings amongst the ERP stakeholders. Firm 6 emphasised the importance of effective communication during the study of a company's business processes.

One of the reasons for observing a high level of user resistance in firm 7 was ineffective communication. Employees of the organisation were not informed and updated about project progress on a regular basis. In firms 8 and 9 also, effective communication was found to be lacking. In firm 8, there was incomplete and wrong information due to the lack of formal communication between end-users and the in-house ERP team.

The above analysis suggests that most of the case studies were aware of the importance of effective communication but only firms 1, 2, 3, 4 and 5 made efforts to use regular communications during their ERP systems implementation. The lack of communication among ERP stakeholders and employees in firms 7, 8 and 9 led to users' resistance towards the new system and difficulty in the developers understanding the needs of users.

7.5.5.2 Group analysis

The firms in both groups A and B adopted regular and effective means to communicate about the ERP project work in their organisations. However the mode of communication was found to be different, with firms 3 and 5 adopting a wider range of different communication channels and firms 2, 4 and 6 using mainly meetings.

A major concern during the project implementation was to keep employees of the firm updated on project progress and to keep continuous interaction between implementation partners and the ERP in-house teams. In the previous study by Lopes and Galletta (1997), the capacity to frequently update information is considered as an important IS resource.

Regular contacts and interactions helped to identify emerging issues that required immediate action. It also helped in the performance of other important ERP activities. For example, firm 6 emphasised the importance of effective communication during the study of a company's business processes. Cross-functional team members from the departments concerned assisted by providing information and knowledge about business operations. In this way, important and accurate business knowledge could be collected from the relevant staff and integrated in order to fully understand way the firm functioned. Moreover, effective communication resulted in much lower resistance from the end-users. In some cases in group A, the top management and implementation team helped the employees to understand the need and importance of ERP systems in the firm. Employees were, provided with adequate knowledge and familiarity with ERP technology through presentations and training. This helped in faster ERP implementation. Thus, effective communication is one of the important variables that can affect implementation of ERP, which is consistent also with DOI theory (Rogers, 1983).

The impact of ineffective communication on implementation success can be observed in group C. The lack of useful communication among ERP stakeholders and employees in the

firms of group C contributed to users' resistance towards the new systems and difficulty in understanding the needs of users by the developers. In these firms, the employees were not informed and updated about project progress on a regular basis. To some extent users' resistance resulted from the lack of involvement from top management and the absence of IT management practices. Thus, top management and internal communication networks of the firm have linkages that together can contribute to implementation success. In the literature also, IT management practices, capacity to manage IT change (Benjamin and Levinson, 1993), capacity to frequently update information (Lopes and Galletta, 1997) have been identified as important IS resources.

7.5.6 Training resources and skills

7.5.6.1 Cross-case analysis

In firms 1, 2 and 6 training was structured, systematic and well planned. Training was conducted separately for the head of departments, the IT Manager and the key users. In firm 1, an empty part of the office was dedicated for training. Providing dedicated space for the training suggests management's commitment to the ERP training process. In firm 1, key users to be trained were selected from relevant fields like production, finance and distribution. These key users were trained in such a way that they could train other end-users. The training lasted about 1-3 weeks depending on learning capabilities and earlier knowledge of the learners involved. Training content included both technical and functional knowledge.

In firm 2 extensive training was undertaken by the project champion, key users from all departments and staff from the IT department. Training duration varied from one week to four weeks depending on the requirements and skills of the staff. The training was given to end-users on how to use the new system about two months before the ERP system went

live. It was ensured that the training helped end-users to change their mindsets and adapt to the new ERP system.

In firm 3, training was provided in two phases. The first phase included training on the overall concept of ERP to all ERP team members and key users. Then before the system went live, key users were trained in their respective ERP related modules. Technical training was given to the IT staff. Similarly to firm 1, in addition to the in-house training other organisations were visited by the ERP team members in firm 3 to understand how their ERP system works. This provided an opportunity for team members to learn from other firms' experiences and share information.

Similar to other firms, customised training was given in firm 4 depending on the involvement of ERP team members in ERP related project activities. However, problems were encountered initially during training as many people did not have a basic knowledge of computers. Therefore, basic training on the use of computers was also given in addition to ERP training. Technical training was given to the IT people. Training was given a priority and significant investment was made in it by top management.

Training strategies were developed in advance in firm 5. Most of the issues relating to training were addressed during the project planning phase. For example associated costs, time plan and the selection of people from different functional disciplines to be trained were all addressed. Training has been given to 25 staff in this organisation. In addition to end-users, training on basic ERP concepts was conducted for all Heads of Departments and the in-house core team members. The training was conducted at a remote location rather than in the office.

Similar to firm 3, phased training with a focus on technical and functional education was conducted in firm 6. Training was considered an important part of making the ERP

implementation successful, with an emphasis on how much had been learnt by those that had been trained.

> *...I can say two things are very important related to training. The first thing is when the training is provided. Ideally it has to be given in phases and secondly you need to find out the absorption of knowledge and learning by users from the training - to see how much of the knowledge they can apply to the real ERP implementation (Assistant Manager, firm 6).*

In firms 7, 8 and 9, formal training sessions were not held. In firms 8 and 9 training was given to users mainly on data entry. The training was given by the Head of IT/IT Manager who themselves had not been trained formally and thus lacked full working knowledge of ERP systems. In firm 8, training was given by the Head of IT because training institutes for ERP were viewed as costly and the management was not ready to spend enough money on it to allow the use of such external training facilities.

In firm 9, limited training sessions were held by the IT team, complemented by some informal training sessions held with the local vendor. The local vendors' themselves did not have sufficient ERP knowledge and implementation experience to undertake extensive training. The Manager who acted as the project champion did not have any previous experience of ERP implementation. He also did not undergo any kind of training. Emphasis was mostly on technical training rather than on the overall concept of ERP and functional training. It was not felt that there was a need for substantial training because the technical Advisor (project champion) felt that people only needed to know how to enter the data in ERP system. This clearly shows that even the project champion did not understand the complexity involved in making users understand and use a new system effectively.

The above cross-case analysis suggests that firms 1, 2, 3, 4, 5 and 6 recognised the importance of both technical and functional training for the ERP team and users. Training

was well planned and carried out either by the implementation partner or by reputable training institutes. The case study participants from most of these firms indicated relevant training for key users is crucial to make the ERP implementation successful in the firm. Compared to this, only limited training was conducted in firms 7, 8 and 9 either by the Head of IT or local training institutes. There were informal sessions to provide information to the key users about the details of how ERP system works (for example, on data entry) rather than a wider education of how the ERP could improve the operations of their functional area of the firm. The staff who conducted these informal sessions did not themselves possess significant ERP knowledge as they had not gone through any formal training and had no prior ERP implementation experience.

7.5.6.2 Group analysis

Training was considered very important in all the four firms in group A. Therefore, significant investments were approved by top management for customised ERP training provided by the implementation partners. Similarly, group B firms developed extensive training strategies and considered training very important for ERP implementation success.

Compared to groups A and B, only limited training was conducted informally in group C firms by the Head of IT or local training institutes. Informal sessions were used to provide information to the key users about how the ERP system works (for example, on data entry).

The foregoing discussion suggests that relevant functional and technical training through efficient training processes contributed to successful ERP implementation in groups A and B firms. Their limited financial resources led group C firms to only undergo in limited training. This in turn resulted in partial knowledge of the ERP implementation process in group C firms that added to their unsuccessful ERP implementation.

The above analysis also highlights that the training process can be linked to the perspective or support of top management because they provided financial resources for the training in Groups A and B firms. Training can also be related to the ability to use external knowledge, by drawing on the prior ERP knowledge and experience of the trainers. Through training, team members have increased technical and functional ERP knowledge in firms from groups A and B. This in turn has helped them to understand the significance of BPR through which ERP solutions' fit with a firms' business processes have been seen in groups A and B. Through training, end-users received familiarity with the system and when the system went live, there were less input errors. These again in turn also assisted end-users to be convinced that through ERP system, their work efficiency would be enhanced. Thus, the level of acceptance was higher when the system went live in the firms in groups A and B.

7.5.7 ERP team members

7.5.7.1 Cross-case analysis

Firms 1 and 3 created an in-house team that was totally dedicated to the ERP project. In firm 1, dedicated team members were chosen based on interviews. The main emphasis for selection of team members was their IT knowledge, interest, approach and attitude towards the implementation of new technology. Further, emphasis was placed on how much respect others had for these individuals, so that team members could win the support of other employees during the implementation process.

In firm 3, the Head of IT and Chairman and Managing Director both noted that the in-house cross-functional ERP team was named 'Dream Team' and it worked only on the ERP implementation until the implementation was complete.

In contrast, firms 2, 4 and 5 could not form a team dedicated to ERP project activities alone due to the unavailability of staff. In firm 4, the best people from the organisation were selected for the core team based on their interest in learning new technology and self motivation.

In firm 5, an in-house ERP team consisted of staff from different functional disciplines. However, it was not a team dedicated only to project activities during the project duration. Therefore, it was sometimes hard to get enough time for the project, as people were working simultaneously on their day-to-day company work. The in-house ERP team was selected based on their high motivation, IT ability and interest in learning new technology. However, the ERP team had to be changed when four staff in it left the organisation during the implementation process.

> *Every team member is like a pillar, providing strength to the project...Without a good and committed team, the ERP project becomes more complicated...Frequent changes in our team affected the working of everyone and the project progress. Our initial team was very good but later on with the problems arising...people leaving the organisation... (Assistant Manager, firm 6).*

Dedicated and committed ERP teams were found to be absent in all the three firms 7, 8 and 9. In firm 7, the Advisor (technical) and IT Manager agreed that they did not have a dedicated in-house ERP team. It is clear from the following statement that in their view only IT personnel are required for the implementation and other people are needed only for data entry.

In firm 8, the Head of IT acted as project champion and about 4-5 team members from the IT department were involved in the ERP implementation. An absence of people possessing business knowledge from the in-house ERP team can be seen in this firm.

Similar to firms 7 and 8, in firm 9, the firm lacked any formal ERP team, with work being allocated according to the availability of staff. Due to this, project activities were not completed by the staff as they knew they would only have to work on the ERP project for few hours or may be 1-2 days. The staff tended to neglect the project activities so next time the Manager would not approach them with project work.

The summary of the above analysis is shown below in figure 7.7. This figure clearly shows that lack of formal ERP team in firms 7, 8 and 9 and frequent changes in ERP team in firm 6 can be one of the reasons for the implementation delay in these firms.

Figure 7.7 - Effect of dedicated full time ERP team on ERP implementation duration

Implementation period	Presence of full time in-house ERP team	Presence of part-time in-house ERP team	Lack of formal ERP team formation	Change in in-house ERP team
Less	Firms 1 and 3	Firms 2 and 4		
		Firm 5		Firm 6
More			Firms 7, 8 and 9	

Source - Compiled by the author

7.5.7.2 Group analysis

With regard to ERP in-house team members, two similarities across the firms from groups A and B can be noted. First, all firms had a formally constituted in-house ERP implementation team with assigned activities. Second, most of the firms had cross-functional team members. However, a difference was seen in the working pattern of these implementation teams. For example, on one hand, firms 1 and 3 had in-house teams that were totally dedicated to ERP project tasks. In contrast, firms 2, 4 and 5 had only part-time teams with members needing to balance their project activities with their routine day-to-day work.

Dedicated teams were found to be lacking in all the three group C firms. Rather, tasks were specified according to the staff availability on a daily basis. In firm 7, the project champion had a view that only IT people are required for the implementation and therefore the ERP implementation process in this firm only involved IT people.

7.5.8 Summary - CSFs

Table 7.7 illustrates the differences in terms of CSFs in groups A, B and C.

Table 7.7 - Comparison between groups A, B and C

	Group A Firms 1, 2, 3 and 4	Group B Firms 5 and 6	Group C Firms 7, 8 and 9
ERP implementation	Successful	Successful (but delayed implementation)	Unsuccessful (to date)
Top management support	Support and involvement of top management in ERP project tasks observed. For example in vendor selection process, ERP team formation, project planning and allocation of resources.	Top management full involvement was noticed during initiation and planning phase but their support reduced during implementation phase.	Support rather than involvement was available but ERP implementation was considered as IT project rather than as a business project leading to limited top management involvement.
Communication	Effective communication observed among different ERP stakeholders throughout ERP implementation.	Effective communication was maintained throughout the ERP project implementation.	Ineffective communication did not reduce users' resistance and led to confusion about project progress.
Project planning	Detailed planning of ERP systems implementation project carried out.	Both firms developed project plans but firm 6 could not follow the plans because of certain challenges appeared that were not foreseen.	Detailed planning found to be lacking in firms 7, 8 and 9.
Vendor selection process	ERP vendors who are market leading were selected. Vendors were chosen based on company's business processes and on certain specified parameters like vendors' implementation success rate, ranking in the market etc.	Vendors who are market leading were chosen by both firms. However, firm 5 chose vendor based on another company's recommendation from different industry rather than choosing vendor based on their own industry.	Local vendor and in-house ERP was chosen based on costs rather than based on suitability.
Business process re-engineering and customization	A balance maintained between customisation and BPR. Only necessary changes were made in the standardised software.	Both firms have made necessary changes in the business processes.	No changes in the business operations or processes were made because local vendors provided fully customised software rather than standardised ERP software.
Training	Extensive training on both functional and technical ERP was provided.	ERP training strategies were developed in detail during the project planning phase by both the firms.	In-house training provided as and when required. The trainings were mainly for the data entry techniques for the end-users.
ERP team	Presence of dedicated and committed ERP team.	In-house ERP team also involved in office work along with ERP project activities.	There was no formal ERP implementation team formation.

7.6 Absorptive capacity of the nine case study firms

7.6.1 Introduction

This section explores the absorptive capacity of case study firms in order to understand if and how it influences ERP implementation success. The analysis is informed by the framework (figure 4.5) discussed in section 4.4 (chapter 4).

Sub-section 7.6.2 analyses prior knowledge of top management and the ERP implementation team. Firms' existing and improved technological skills and business understanding is analysed in sub-section 7.6.3. Increases in firm's absorptive capacity during ERP implementation through training and effective communication is analysed in sub-section 7.6.4.

7.6.2 Prior ERP knowledge

Table 7.8 shows top management and the firm's implementation team's prior knowledge in terms of ERP implementation success factors, based upon the analysis undertaken in section 7.5. It shows firms 1, 2, 3 and 4 who had implementation success within the time schedule have higher levels of understanding and knowledge of factors to be considered in ERP implementation as compared to firms with implementation success but delayed in implementation (firms 5 and 6) and firms with unsuccessful implementation (firms 7, 8 and 9).

Table 7.8 - Absorptive capacity - prior ERP knowledge base

	ERP implementation knowledge	
	Top management	**Firm's ERP implementation team**
Firm 1	High	High
Firm 2	High	High
Firm 3	High	High
Firm 4	High	High
Firm 5	Medium	Medium
Firm 6	Medium	Medium
Firm 7	Low	Low
Firm 8	Low-Medium	Low-Medium
Firm 9	Low	Low

In firm 1, the level of prior ERP implementation knowledge was high within the implementation team as the first unsuccessful implementation provided valuable lessons and useful knowledge about ERP requirements (for instance, about customisation and the importance of a suitable vendor). Top management full involvement and guidance shows their understanding of the ERP implementation process. In firm 2, top management provided business leadership because they had good project planning techniques, understanding of ERP functionality and its importance to their firm. The Chairman stressed a lack of knowledge by SMEs on project planning as one of the major reasons for ERP implementation failure. Furthermore, the Chief Information Officer and the top management possessed prior knowledge on how customisation of ERP software could lead to increased implementation costs and time. In firms 3 and 4 also, top management and the

ERP implementation team had good knowledge of implementation success factors (such as project planning, suitable vendor selection process, influence of customisation, importance of BPR and importance of users' feedback).

Both firms 5 and 6 in group B did not receive project direction consistently from the top management because management's prior implementation knowledge was not high. As a consequence, after a few months they started to consider the ERP implementation as more of an IT project rather than a business project. For instance, in firm 5, vendor selection was based on the recommendation of another company with different business practices rather than the firm's requirements. This shows their lack of knowledge of the significance of the vendor selection process.

Group C (firms 7, 8 and 9) analysis shows that prior ERP implementation knowledge was low in these firms. In particular their knowledge of project planning, how customisation can affect implementation, their understanding of BPR and the importance of users' feedback was found to be very low.

The discussion in section 7.5 confirms that the CSFs play an important role in ERP success. These factors can be associated with previous knowledge, learning capabilities, prior implementation experience of top management and ERP team members. It would appear group A firms have higher absorptive capacity which led to their ERP success. Zahra and George (2002) suggested absorptive capacity as an important factor for an organisation to implement new IS successfully. According to these authors, prior related knowledge is one of the important components of absorptive capacity. This was clearly present in group A and to some extent in group B but absent in group C.

The next sub-section discusses absorptive capacity in terms of technological skills and business understanding possessed by top management, the firm's ERP implementation team and ERP vendors.

7.6.3 Absorptive capacity - technological skills and business understanding

Table 7.9 shows that group A firm's implementation team consisted of members with high levels of absorptive capacity with regard to technological skills and business understanding. In firm 1, the IT manager and user both stated that their project champion had a very good understanding of business processes and had a good technical background. The ERP implementation manager indicated that well-known ERP vendors have wide experience with different firm's and can provide an opportunity to select software solutions that best suit the way a business functions. Due to their earlier failed implementation, firm 1 was aware that ERP customisation could lead to delay in the project. Similarly in firm 2 the Chief Information Officer stated he had knowledge of business processes of the firm and explained its importance for ERP to be completed on time. Case study participants in firms 3 and 4 also indicated that modification of the ERP system code can lead to delays in the project and increases in project costs. The IT Manager in firm 4 stated '*we wanted best people in our team with very good business knowledge*'. Thus, these firms understood the importance of technological skills and business understanding and their implementation teams consisted of people with higher levels of both technical and business skills.

Similarly, in group B firms 5 and 6, ERP implementation team had high levels of both technological skills and business understanding. For example, in firm 5 both the IT Manager and the Manager-Systems stated that the in-house ERP team consisted of about 8 members, of which, 5 had business knowledge and the remaining had good technical background and knowledge.

In contrast, group C firms 7, 8 and 9 had considered ERP implementation as an IT project and not as a business project. Analysis of these firms showed an absence of personnel in the implementation team possessing business knowledge, rather, their implementation teams had personnel with technical backgrounds. However, it can be summarised that their

technical knowledge was low because they were unable to solve issues involved with customisation, which was one of the factors that led to implementation failure.

Table 7.9 - Technological skills and business understanding

	Firm's ERP implementation team	ERP vendors
Firm 1	T and B (High)	T and B (High)
Firm 2	T and B (High)	T and B (High)
Firm 3	T and B (High)	T and B (High)
Firm 4	T and B (High)	T and B (High)
Firm 5	T and B (Medium)	T and B (Medium)
Firm 6	T and B (Medium)	T and B (Medium)
Firm 7	T (Low)	T (Low)
Firm 8	T (Low)	T (Low)
Firm 9	T (Low)	T (Low)

T - Technological; B - Business; T and B - Technological skills and business understanding

Customisation of ERP software is time consuming and requires significant technical skills, implementation experience and a thorough understanding of a firm's business processes and operations. The analysis shows that group A firms had both the implementation team and vendors with high levels of technological skills and business understanding. The knowledge of how to minimise customisation and the importance of BPR was very low in group C firms. In firms 7 and 9, neither the in-house implementation team nor the vendor's team possessed enough knowledge of ERP systems to make modifications to the software. This had a negative impact on the implementation duration and implementation success.

Thus low absorptive capacity in group C firms led to on-going need to consider ad hoc customisation by the organisations. This has affected the ERP implementation process and contributed to the unsuccessful ERP implementation.

7.6.4 Training and communication

Table 7.10 shows that group A firms 1, 2, 3 and 4 improved their ERP implementation knowledge by means of the comprehensive training and effective communication processes during the ERP implementation. The analysis in section 7.5 with regards to training and communication processes highlights that group A firms had efficient training process and effective communications during ERP implementation. In addition to effective communication, attempts were made by firms 1 and 3 to gain ERP knowledge by communicating with other firms. For instance sites of customers of the ERP vendors were visited separately by the top management and the ERP team members. Similarly, the Chairman and Managing Director of firm 3 stated '*...visited other organisations to see how they work on their ERP system*'. In firm 3, the management and IT team attended a number of seminars by software companies to increase their understanding of ERP and its suitability for the firm's processes. Thus these firms shared the experiences and knowledge of other firms. This resulted in enhancing the firms' absorptive capacity of the ERP implementation process. Effective training also helped in understanding and increasing the level of implementation knowledge among the ERP implementation teams and they applied this learned knowledge in the implementation process to achieve ERP implementation success. Furthermore, training customised according to the specific learning capabilities and requirements of users' in these firms also helped in increasing their existing absorptive capacity.

Table 7.10 - Improvement in firm's existing absorptive capacity during ERP implementation

	Through efficient training process	Through effective communication processes and sharing knowledge with ERP team members/top management/vendors
Firm 1	*	*
Firm 2	*	*
Firm 3	*	*
Firm 4	*	*
Firm 5	*	*
Firm 6	*	
Firm 7		
Firm 8		
Firm 9		

In firms 5 and 6 also, training helped in increasing the existing absorptive capacity of firms. Effective communication was present in firm 5. In firm 6, the IT Manager stated that not enough effort was made to increase the level of communication about the ERP project in the organisation. Furthermore, in these firms neither top management nor the implementation team members made an attempt to gain knowledge from other firms. Thus, only firm 5 increased their absorptive capacity through both effective training and communication.

As mentioned in section 7.5, group C firms 7, 8 and 9 had a lack of technical and functional training during ERP implementation. Also, efforts were not made by these firms to improve communications within their firm's. Thus, training and communication did not add to the existing ERP knowledge of these firms.

Regular contacts and interactions helped to identify emerging issues that required immediate action in group A firms. It also helped in the performance of other important ERP activities. Consistent with the work of Cohen and Levinthal (1990), this suggests the firms in group A have increased their absorptive capacity through effective communication. As discussed in chapter 4, according to these authors, effective communication connects the organisation and is essential for enhancing absorptive capacity and integrating functional units. Although studies have related ERP implementation success to effective communication, those that relate it to enhanced absorptive capacity have not been found. Some studies identify functional integration and cross-functional teams as a key success factor when implementing automated manufacturing technology (Goldhar and Lei, 1994) and successful adoption of manufacturing technology (Chen and Small, 1994).

7.7 Summary

Firms in group A as compared to groups B and C appear to have utilised human, business and technical resources appropriately and addressed CSFs to attain ERP implementation success. Firms in group A also have been found to have higher absorptive capacity than firms in the other group, which appears to have contributed to their ERP success in the ways described in the previous section.

CHAPTER 8: RESEARCH FINDINGS

8.1 Introduction

In this chapter, the research findings derived from the analysis of the nine case study firms are discussed in the context of the research questions introduced in chapter 4. Section 8.2 presents a brief overview of specific research questions and findings. These findings are discussed in detail in section 8.3.

8.2 Overview - research questions and findings

Table 8.1 presents an overview of the research objectives, research questions and findings. These are discussed in detail in the following section.

Table 8.1 - Research questions and findings

Research objective 1 - To explore how ERP can be implemented successfully in Indian medium sized firms. Research objective 2 - To study why only some firms are able to implement ERP successfully, while others experience implementation failure. Research question 1 - How do ERP implementation strategies influence ERP implementation success in firms? Finding - A big bang implementation strategy through a market leading ERP vendor contributes to successful ERP implementation. However, the choice of vendor and implementation strategy depends on top management support and the availability of resources. Research question 2 - How do the different factors that are critical to the successful implementation of ERP interact in order to achieve that success? Finding - Strong inter-linkages between CSFs exist with top management support playing a central role. The inter-linkage between CSFs means that the presence of all of them is important for ERP implementation success. Research question 3 - How does the absorptive capacity of the firm influence the successful implementation of ERP? Finding – A high absorptive capacity is an important CSF and contributes to firm's capability to implement ERP systems successfully.

8.3 Findings

8.3.1 Introduction

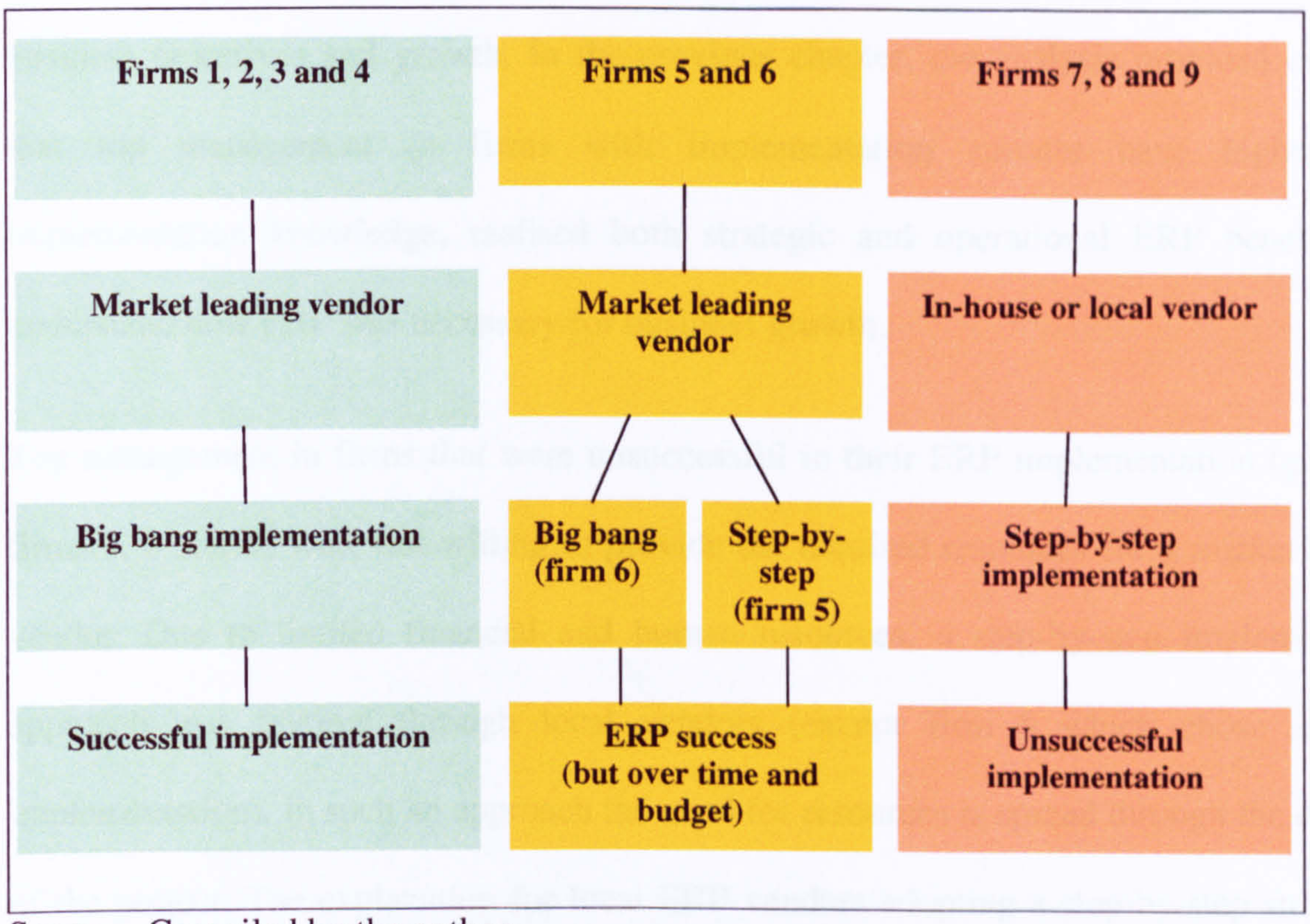
This section discusses the findings of the current study in the context of the research questions presented in chapter 4 (section 4.5). The main objective of this research is 'to explore how ERP can be implemented successfully in Indian medium sized firms'. To understand the process of ERP implementation and how different factors (such as the implementation strategy, firms' internal resources, absorptive capacity, CSFs and their interaction) influence ERP implementation success, nine case study firms with varied levels of implementation success were analysed in the previous chapter. Based on this analysis the research questions and findings are discussed in the following sub-sections.

8.3.2 Research question 1 - How do ERP implementation strategies influence ERP implementation success in the firms?

8.3.2.1 Discussion

The analysis in the previous chapter illustrates that firms 1, 2, 3, 4 and 6 who implemented ERP through a big bang strategy using market leading ERP vendors, completed their ERP implementation successfully. In contrast, using a step-by-step approach with an in-house/local vendor, did not lead to successful implementation in firms 7, 8 and 9 (figure 8.1). Firm 5 implemented successfully through a market leading ERP vendor, but used a step-by-step implementation strategy.

Figure 8.1 - Implementation strategy adopted by firms



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It is evident that firms, who succeeded, implemented through a big bang approach (except firm 5) with market leading ERP vendors. The big bang implementation strategy means that firms have to consider the impact of ERP on the whole firm. The market leading ERP vendors provide an opportunity for their clients to share their wide international implementation experience, good knowledge of ERP implementation process, understanding of business processes and information on most of the challenges that emerge during implementation. So, these firms avoided most of the challenges and had planning in place to react to situations that might adversely affect the implementation process. Furthermore, the availability of a range of ERP solutions from the market leading vendors to fit the firm's business operations allows minimal customisation that saves firm's resources, in particular, implementation cost and time. However, selecting market leading ERP vendors for Indian medium sized firms is a difficult decision because their solutions are expensive. The decision to select a market leading vendor's ERP solution to a great extent lies with top management of the firm. For this to happen, top management should

have an understanding of how ERP could benefit their particular firm in terms of achieving business objectives and growth. In the previous chapter, the analysis provided evidence that top management in firms with implementation success have higher ERP implementation knowledge, realised both strategic and operational ERP benefits and understand how ERP was necessary for business growth.

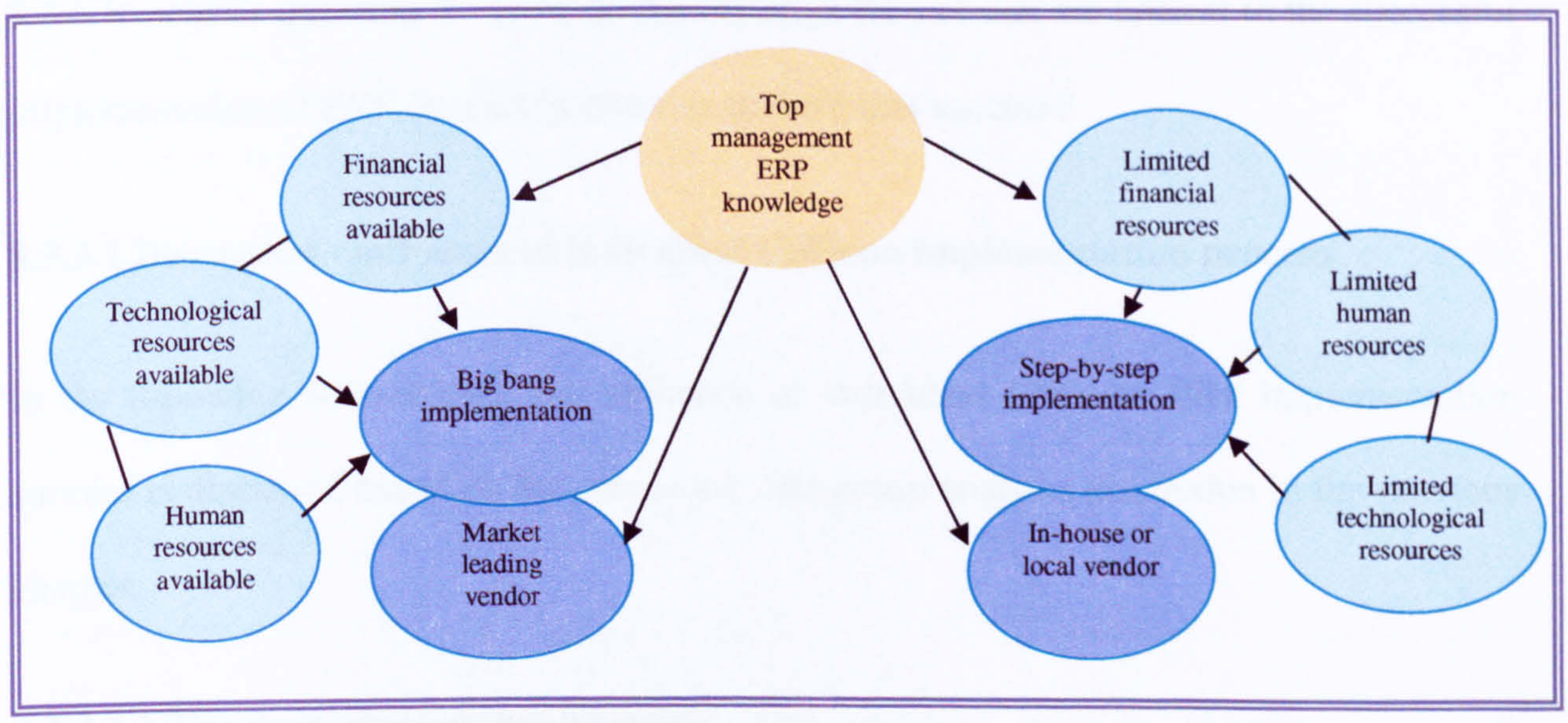
Top management in firms that were unsuccessful in their ERP implementation (group C-firms 7, 8 and 9) were not willing to provide the required resources for a market leading vendor. Due to limited financial and human resources, a step-by-step implementation approach was favored through local vendors (except firm 8 which chose in-house implementation). In such an approach the need for resources is spread through the duration of the project. The explanation for local ERP vendors adopting a step-by-step strategy is that in India in recent years there is an enormous growth of local ERP vendors. However, not all these local vendors possess enough experience or resources, in particular skilled human resources with ERP technical knowledge, management skills and ERP functional knowledge necessary for a big bang ERP implementation. Therefore, local vendors show a preference for step-by-step implementation.

The explanation for an unsuccessful outcome in step-by-step implementation in the three firms 7, 8 and 9 is that step-by-step strategy is spread over a long period of time and focuses on parts of the business as compared to a big bang approach. It is difficult to maintain consistency in team work, their enthusiasm and focused approach (for example, firm 5). Furthermore, securing the effort of all Heads of departments, the interest of personnel and their retention for the duration of the whole implementation is difficult, for example, in firm 9 when employees left the organisation during implementation. The local vendor themselves may lose interest in implementation (for instance, in firm 8 during their first ERP implementation) if they are not able to implement successfully within the specified time.

Firm 5 provides an interesting case of use of a market leading vendor, but using a step-by-step implementation strategy. Whilst it is not possible to draw findings from one case, this does suggest that the knowledge and expertise of an experienced vendor is more important than the choice of implementation strategy. It would appear that, even when resources may be limited, suggesting a step-by-step approach, an experienced vendor can guide a firm through implementation successfully.

The above discussion implies a link between top management ERP knowledge, resources availability, ERP vendors and selection of implementation strategy (figure 8.2).

Figure 8.2 - Link between top management, resources, vendor's choice and implementation strategy



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The discussion suggest firms implementing through market leading ERP vendors and big bang implementation are more successful in ERP implementation compared to step-by-step implementation strategy through local vendors. However, big bang implementation requires significant human resources, financial resources, technical skills, management's continuous interest and focused approach, throughout the implementation period. Thus, big bang implementation and a market leading vendor does not ensure implementation success because this in turn is related to firm's top management commitment, vendor selection

process, possession of human, business and technology resources. This is discussed further in the following sections. Empirical studies, particularly in an Indian context, suggesting the relationship between implementation strategies, local vendors and market leading vendors and their inter-linkages are found to be absent in existing ERP literature.

8.3.2.2 Key finding

It can be concluded that a big bang implementation strategy through a market leading ERP vendor contributes to successful ERP implementation. However, the choice of vendor and implementation strategy depends on top management support and the availability of resources.

8.3.3 Research question 2 - How do the different factors that are critical to the successful implementation of ERP interact in order to achieve that success?

8.3.3.1 Discussion - influence of individual CSFs on implementation process

In the following sub-sections, the influence of individual CSFs on ERP implementation success is discussed based on the cross-case and group analysis discussion in the previous chapter.

8.3.3.1.1 Top management involvement

The following quotes demonstrate that top management commitment was found to be important in ERP implementation success -

...without our support it is difficult for the IT Department to implement ERP by themselves... (Chairman and Managing Director, firm 3).

Without management intervention nothing moves... (Executive, firm 4).

...in our company management has taken ERP as their baby and they handled it well...that is why we have been successful... (IT Manager, firm 4).

...there are very high failure rates of implementing ERP...it requires total commitment from the management...by leaving it to the IT department...you cannot implement ERP in a company (IT Manager, firm 5).

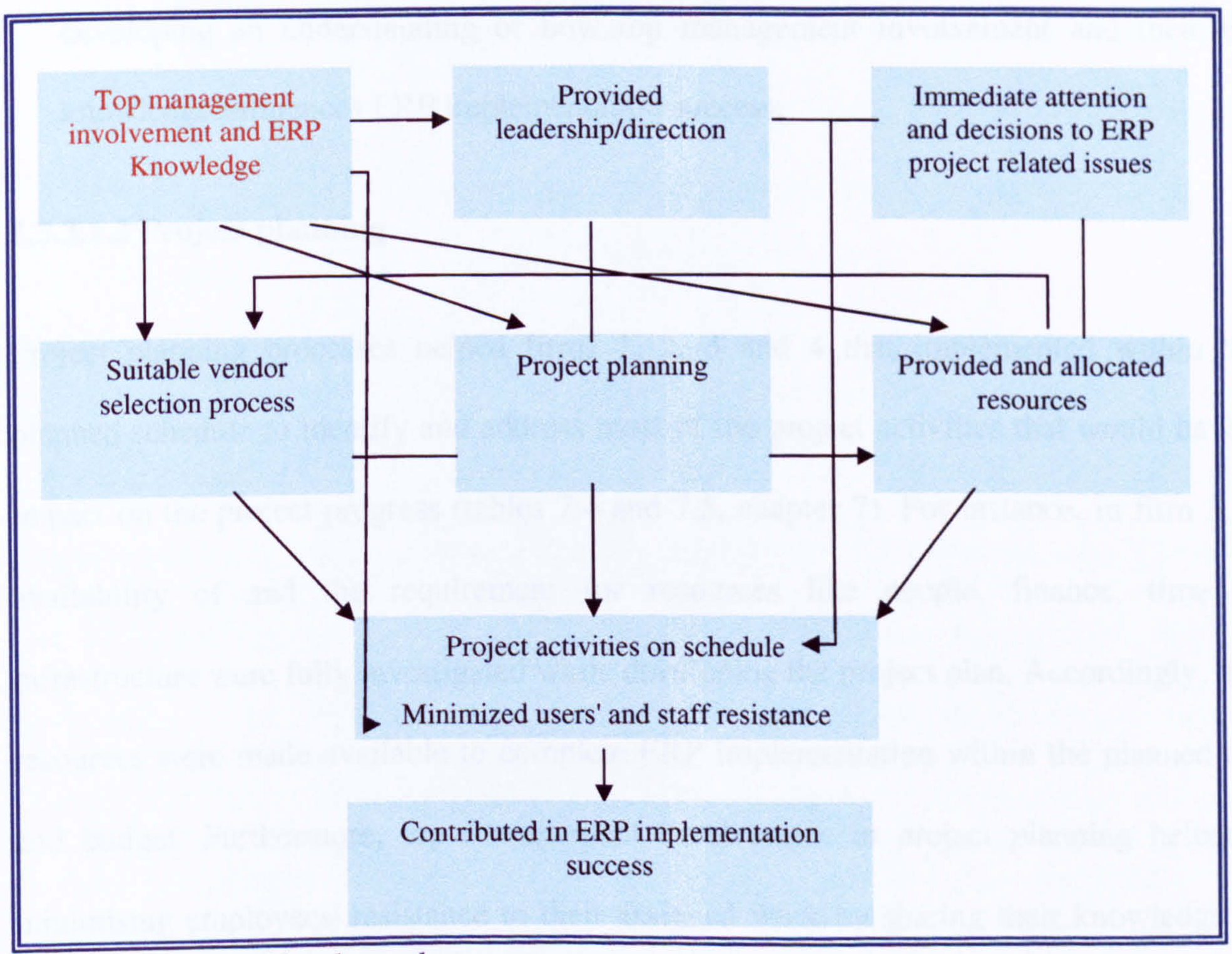
All the firms (1, 2, 3 and 4) who had succeeded within the scheduled implementation time, not only had commitment but more importantly, strong involvement of top management in most of the important ERP project tasks (chapter 7, table 7.3) such as project planning, vendor selection as well as the effective allocation of human and financial resources. In addition to these, an appointment for meetings with senior management was usually available whenever needed to discuss ERP related issues requiring immediate attention (firm 1). Top management involvement also influenced the employees of the firm to accept the ERP system, reducing resistance to change (firms 1 and 4). A top priority for senior management during implementation was to solve emerging issues and they always gave their time to solve issues as quickly as possible (firms 1, 2 and 3). This resulted in completion of project tasks as scheduled and implementation success. This kind of top management involvement in significant project activities and effective communication with ERP team members shows top management prior and existing ERP knowledge base was well-developed. This experience and knowledge contributed to the higher absorptive capacity witnessed in these firms.

Although firms 5 and 6 described their implementation as successful, the implementation schedule was exceeded. One of the possible causes for this was a lack of continuous top management commitment, which slowed progress on some of the critical ERP project activities because the leadership, decision-making and project direction were not consistently available to the ERP Implementation Manager and implementation team.

The complexity of the ERP implementation process and the high risk of failure associated with it was not understood by the top management in the firms who had an incomplete and unsuccessful implementation (firms 7, 8 and 9). Top management insufficient prior knowledge base of ERP implementation and lack of involvement did not add value to the knowledge of the ERP team (chapter 7, table 7.3). This can be considered as one of the significant reasons for implementation failure in these firms. In chapter 4, the prior knowledge base of top management is described as an important element of absorptive capacity. Top management did not contribute to increasing the absorptive capacity in these firms.

Figure 8.3 is developed from the above discussion and table 7.3 (chapter 7). This figure illustrates top management influence on ERP implementation success.

Figure 8.3 - Influence of top management involvement in ERP implementation success



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A comparison between top management involvement in firms having ERP implementation success or failure in this study, suggests full top management commitment and active involvement throughout the implementation as one of the factors that contributed to the ERP implementation success. One of the most widely cited variables critical to the successful implementation of ERP systems is top management support (Somers and Nelson, 2001; Nah *et al.*, 2003; Al-Mudimigh *et al.*, 2001; Shanks *et al.*, 2000; Loh and Koh, 2004; Lee and Molla, 2006; Mabert *et al.*, 2003). However, most of these studies do not provide detailed empirical evidence of how top management commitment throughout implementation influences implementation success. This research has added to existing knowledge by:

a. Explaining and providing an understanding of how top management can involve themselves in various ERP project activities.
b. Through comparison between firms with implementation success and failure, developing an understanding of how top management involvement and their ERP knowledge influences ERP implementation success.

8.3.3.1.2 Project planning

Project planning processes helped firms 1, 2, 3 and 4 that implemented within their planned schedule to identify and address most of the project activities that would have an impact on the project progress (tables 7.4 and 7.5, chapter 7). For instance, in firm 3, the availability of and the requirement for resources like people, finance, time and infrastructure were fully investigated while developing the project plan. Accordingly, these resources were made available to complete ERP implementation within the planned time and budget. Furthermore, top management involvement in project planning helped in minimising employees' resistance to their assigned work by sharing their knowledge and experience in project planning.

Interviewees from firms with successful implementation had a very good understanding of why ERP project planning is important, for instance,

> *...even small project activities were thought of and time was spent in planning them... (ERP Implementation Manager, firm 1).*

> *...better project management techniques...this is the area where SMEs are lacking because most of them don't have that much knowledge...This is the major reason for the increase in failures of ERP solutions...good project management techniques in implementation it will definitely give you a return (Chairman, firm 2).*

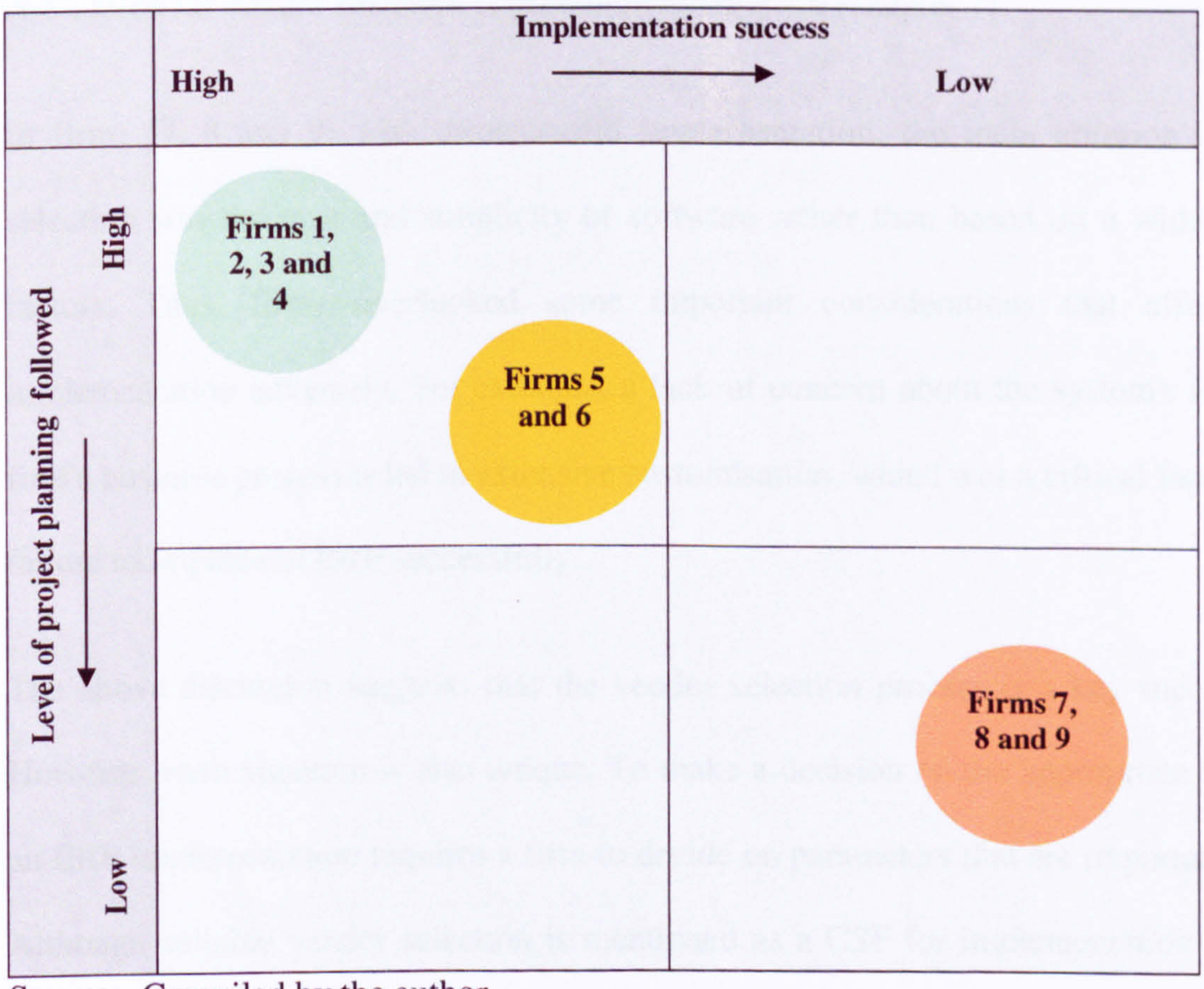
This study suggest that although detailed project planning is significant, it is also important to have a knowledge and familiarity of ERP implementation challenges that may arise and have plans ready for such circumstances. Otherwise, implementation progress may be affected. For example in firm 6, although detailed project planning facilitated the start of the project, after 2-3 months project timelines could not be followed. One of the reasons for this was due to the unforeseen challenges that started emerging during implementation. The firm had to spend time addressing these challenges and this adversely affected the project schedule.

Inadequate knowledge of the level of project planning required (indicating lower absorptive capacity) and its importance specifically in ERP implementation led to very limited planning in firms that had incomplete and unsuccessful implementations (firms 7, 8 and 9). Moreover, neither top management nor the local vendor provided sufficient information on the planning steps necessary to carry out implementation on schedule. For example, the Project Manager (firm 9) admitted it was his first implementation and he had no prior experience of any other IT technology implementation (indicating lower absorptive capacity of the Project Manager), so he himself was not aware of the level of

project planning required. This indicates these firms' lower absorptive capacity in terms of ERP implementation knowledge.

Comparison between firms with implementation success and failure, suggests that firms which undertook detailed planning and followed it, implemented ERP successfully in their firms within the planned schedule (figure 8.4). This highlights the importance of detailed project planning and its role in making ERP implementation successful.

Figure 8.4 - Effect of project planning on implementation schedule and success



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This finding supports earlier studies (Bancroft *et al.*, 1998; Mudimigh *et al.*, 2001; Umble *et al.*, 2003; Nah *et al.*, 2003; Loh and Koh, 2004) that identified project planning as an important CSF. This study has provided additional empirical evidence, from a new context, of the details of project planning activities that are required and ERP stakeholders' participation in planning that is necessary for ERP implementation success.

8.3.3.1.3 Suitable vendor selection

The successful ERP implementing firms 1, 2, 3 and 4 considered a predefined set of criteria for selecting a suitable vendor. For instance, firm 4, chose its ERP vendor after comparing six parameters - implementation success rate, years of experience in the pharmaceutical industry, rating in the ERP market, time required for implementation and level of customisation that would be required. These parameters helped in selecting the most appropriate vendor to implement an ERP system in firm 4. The details on parameters considered for vendor selection is presented in table 7.6 (chapter 7).

In firms (7, 8 and 9) with unsuccessful implementation, the main criterion for vendor selection was the cost and simplicity of software rather than based on a wider range of factors. Thus, firms overlooked some important considerations that affected ERP implementation adversely. For example, a lack of concern about the system's fit with the firm's business processes led to extensive customisation, which was a critical factor in their failure to implement ERP successfully.

The above discussion suggests that the vendor selection process is a key success factor. However, each situation is also unique. To make a decision on the appropriate vendor for an ERP implementation requires a firm to decide on parameters that are important to them. Although suitable vendor selection is mentioned as a CSF for implementation success in existing literature, such studies do not include the details of the vendor selection process and the parameters included in vendor selection. This study provides empirical evidence from nine case study firms on the vendor selection process, parameters considered for selection and its influence on ERP implementation success.

8.3.3.1.4 Business process re-engineering and customisation

Firms 1, 2, 3 and 4 made necessary changes in their business processes to avoid excessive and costly customisation of their ERP solutions and to gain the best practices embodied in the software. The ERP Implementation Managers of these firms were aware and recognised that excessive customisation can increase both initial and on-going costs along with increased implementation duration. Thus, as described in the above sub-section, one of the parameters for selecting a suitable vendor was an ERP solution's fit with the firm's business processes. This knowledge and understanding of BPR and the impact of ERP solution customisation appear to have contributed to firms achieving successful ERP implementations. This discussion illustrates ERP Implementation Managers/IT Managers need to have both a strong technical and functional ERP knowledge base. The prior knowledge and experience of BPR of these Managers contributed to the higher absorptive capacity in these firms.

Similarly, to avoid increased costs and implementation time, firms 5 and 6 in group B initially carried out changes in business processes to fit the ERP software. However, firm 5 had to undertake some customisation at the later stages due to the complexity of the business processes in clothes manufacturing. This was one of the factors that contributed to the delayed implementation in these firms.

Firms 7, 8 and 9 did not conduct business process studies and they made no modifications to their processes to suit the ERP software. These firms were not sure of what changes should be made to their processes so they preferred to make changes to the software as and when required. It is evident here that these firms' ERP technical and functional knowledge was not well-developed (lower absorptive capacity). This resulted in excessive customisation, one of the factors responsible for implementation failure.

The foregoing discussion implies excessive customisation leads to unsuccessful implementation, particularly if a firms' ERP team does not possess relevant ERP technical implementation skills as happened in firms 7 and 9. Therefore, firms need to have a balance between undertaking customisation and making changes in their business processes (Bingi *et al.,* 1999; Huq *et al.*, 2006).

8.3.3.1.5 Effective communication

Most of the firms studied were aware of the importance of effective communication but only firms 1, 2, 3, 4, 5 and 6 used various means to communicate about the ERP project to staff in their organisations. Regular contact and interaction helped to identify emerging issues that required immediate action. It also helped in the performance of other important ERP activities. For example, firm 6 emphasised the importance of effective communication during the study of a company's business processes. Efficient internal communication networks played a significant role in the firm to share ERP knowledge, information and experience between the members of the ERP implementation team and personnel of the firm. This resulted in enhancing the organisation's absorptive capacity about the ERP implementation process.

The following quote illustrates that interviewees considered effective communication during ERP implementation as very important.

> *Effective communication is a backbone of management...We considered it very important...efforts were made to keep people updated on project development through emails, notice boards, weekly and monthly newsletters and meetings to communicate about project activities (Chairman and Managing Director, firm 3).*

The lack of useful communication among ERP stakeholders and employees in firms 7, 8 and 9 resulted in resistance towards the new system and difficulty in understanding the

needs of users. In these firms, the employees were not informed and updated about project progress on a regular basis. To some extent users' resistance resulted from the lack of communication from top management and the absence of IT management practices.

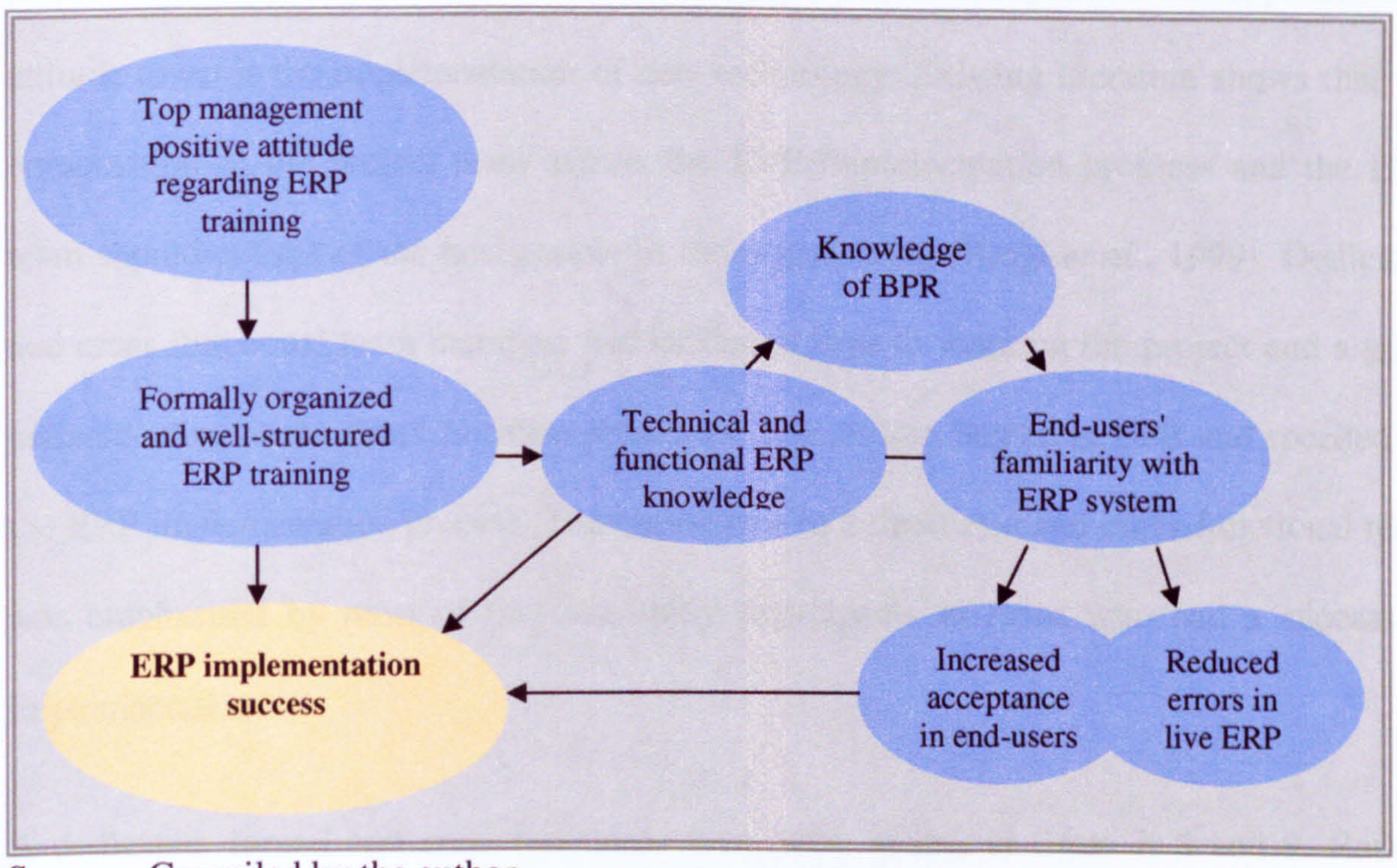
8.3.3.1.6 Training process

In all the firms with implementation success (firms 1, 2, 3, 4, 5 and 6), training was formally organised and well-structured based on the requirement of trainees, their ERP knowledge level and their job tasks. Furthermore, significant investments were approved by top management for customised functional and technical ERP training in these firms indicating their understanding of role of efficient training in ERP implementation success. Through training, team members increased their technical and functional ERP knowledge (thus enhancing their absorptive capacity) that helped them to understand the significance of BPR through which the ERP solution's fit with their firm's business processes was obtained (figure 8.5). This helped in developing the knowledge base of the ERP implementation team, assisting them in applying learned knowledge to the ERP implementation process. This then boosted the absorptive capacity of the firm. Also, through training, end-users became familiar with the system and learnt that through use of the ERP system their work efficiency would be enhanced (figure 8.5), thus reducing resistance to change. Authors, Motwani *et al.*, (2005), Mandal and Gunasekaran (2003), Somers and Nelson (2004) have also reported in their studies that educating staff about the needs for and benefits of ERP system can help to minimise resistance towards a new ERP system in the firm. User acceptance of the ERP project and positive employee attitude are important factors to be considered (Abdinnour-Helm *et al.*, 2003) for implementation success.

Although the studies in extant literature report ERP training as a CSF, details are not provided in most of them. The current study adds to the existing knowledge by illustrating

the process of how efficient training leads to ERP implementation success and its relation with top management perspective and ERP implementation knowledge (figure 8.5).

Figure 8.5 - Association of top management and efficient training process contributes to ERP success



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Limited financial resources led firms 7, 8 and 9 to only provide limited training. Most of the staff who conducted these sessions did not possess significant ERP knowledge themselves as they had not undergone any formal training and had no prior ERP implementation experience. This lower prior experience and knowledge of key staff suggests lower absorptive capacity in these firms. This in turn resulted in only partial knowledge of ERP implementation process in these firms that added to their unsuccessful ERP implementation.

In summary, relevant functional and technical training through efficient training processes contributes to successful ERP implementation.

8.3.3.1.7 ERP team

The firms that were unsuccessful with implementation selected their best personnel based on their interest in ERP technology to form an ERP team. For instance, in firm 1, the main emphasis for selection of team members was their IT knowledge, interest, approach and attitude towards the implementation of new technology. Existing literature shows that the composition of the project team affects the ERP implementation progress and the ERP team should consist of the best people in the organisation (Bingi *et al.*, 1999). Dedicated and cross-functional team members had sufficient time to work on the project and a good understanding of the firm's business processes. This in turn helped in BPR and speeded up the ERP implementation process. The importance of a dedicated and cross-functional team was emphasised by most of the case study participants in firms who had a successful implementation.

A dedicated, formal and cross-functional team were absent in firms 7, 8 and 9. Rather, tasks were allocated according to staff availability on a daily basis. Further, the Implementation Managers in these firms did not understand why cross-functional team members are necessary in ERP implementation. For instance, in firm 7, the project champion had a view that only IT people are required for the implementation and therefore, the ERP implementation process in this firm only involved IT people. An absence of team members possessing business knowledge adversely affected the ERP implementation process. An implementation team consisting of a balance of business and IT staff has been emphasised repeatedly in the existing literature (Nah *et al.*, 2001; Siriginidi, 2000; Willcocks and Stykes, 2000; Somers and Nelson, 2004).

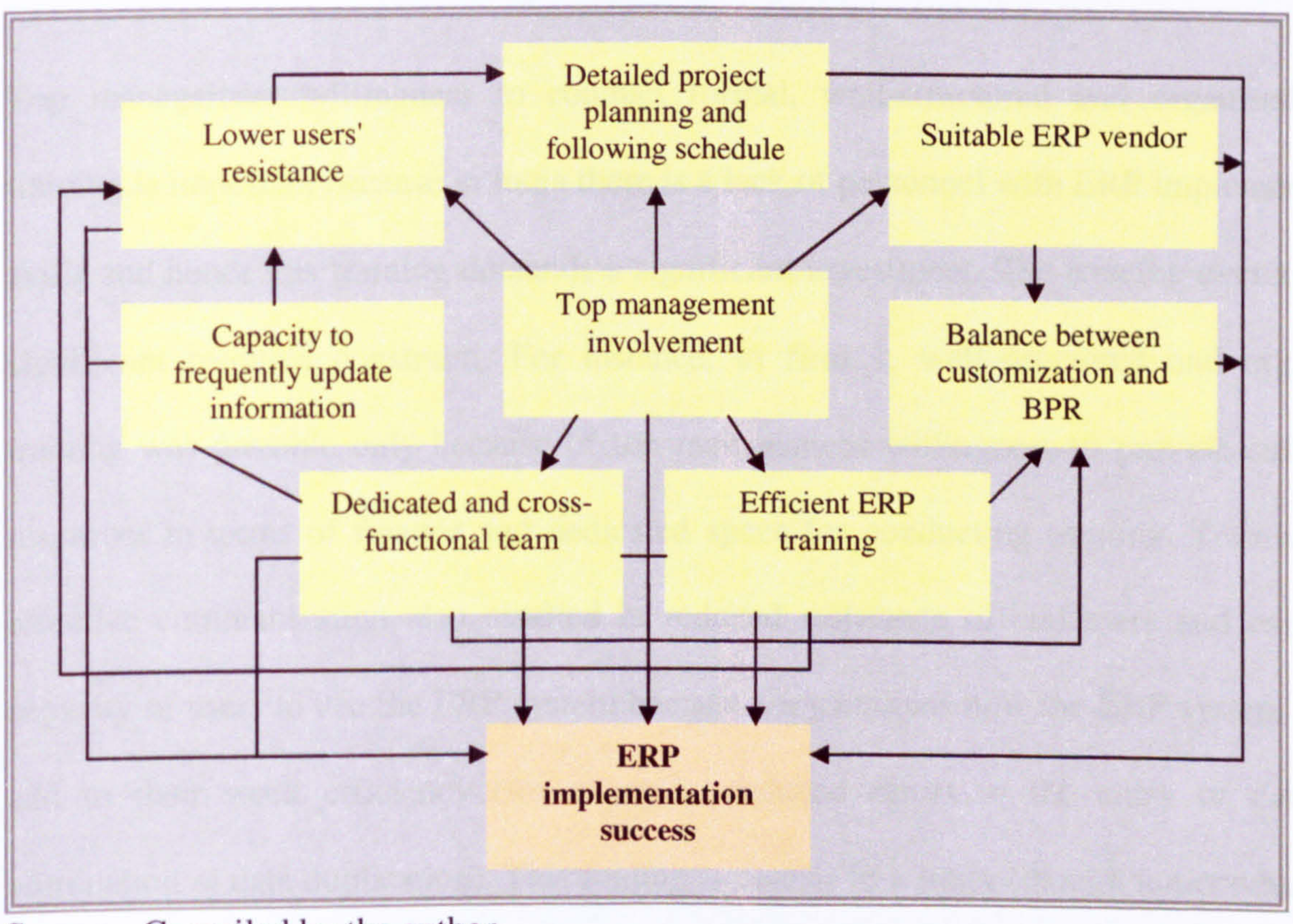
8.3.3.2 Discussion - linkages between CSFs

The discussion in the above sub-sections shows top management commitment, detailed project planning, effective communication, a suitable vendor, a balance between BPR and

customisation, an efficient training process and a cross-functional and dedicated in-house ERP team are CSFs for successful ERP implementation in Indian medium sized firms. However, as evident in the group analysis, these CSFs are associated with each other and the strong interactions and linkages between them is crucial in successful ERP implementation.

The interactions between CSFs based on firms that had a successful implementation are summarised in figure 8.6.

Figure 8.6 - Linkages between CSFs and their influence on implementation success



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This figure illustrates how top management involvement plays a significant and central role because the case studies show that it is linked to all other CSFs and affects them. Their participation in the implementation process is vital due to their knowledge of how the ERP system could provide both strategic and operational benefits to their firm. Their knowledge of ERP CSFs and why their involvement was necessary in the ERP implementation activities helped in their ERP success. Top management active participation in the selection of a suitable vendor helped in choosing ERP solutions that best suited a firm's

business operations. This resulted in a reduced amount of customisation and in turn helped the ERP implementation to be completed within the planned timeframe. The cross-functional team had members with adequate knowledge of different department's operations and thus helped in providing accurate data to the implementation team. The functional knowledge of cross-functional ERP team members was further enhanced through efficient training process. This in turn developed an understanding of BPR and the effects of customisation on the implementation process. It assisted the implementation team in achieving a balance between changes in business processes and the level of customisation to have successful implementation.

Top management willingness to conduct formal, well-structured and organised ERP training is important because in India there is a lack of personnel with ERP implementation skills and hence this training demands a significant investment. The training overcomes a significant resource constraint. For instance, in firm 1, well-structured and organised training was possible only because of top management willingness to provide sufficient resources in terms of finance and dedicated space for conducting training. Training and effective communication also resulted in reduced resistance of end-users and enhanced capacity of users to use the ERP system because they realised how the ERP system would add to their work efficiency (for example, reduced errors in the entry of data and elimination of data duplication). This finding is similar to a study (though not conducted in the ERP context) by Griffith *et al.*, (2003) that reports the capacity of users to apply knowledge can be enhanced by sharing activities across departments, teams, and the organisation. Effective communication contributed to an open environment that led to sharing of knowledge, experience and clearing of doubts about ERP. This in turn contributed to increasing the absorptive capacity of the firms.

8.3.3.3 Finding

Those case studies that successfully implemented ERP (firms 1, 2, 3, 4, 5 and 6) had all CSFs present, whilst those firms that were unsuccessful demonstrated limited degrees of the CSFs. As described above, the analysis suggests that top management involvement and understanding of the ERP implementation process is not simply one of a number of CSFs, as suggested in previous studies, but is a key CSF which enables the other CSFs. The case studies further suggest that the identified CSFs are strongly interlinked. Thus, it is vital to understand these complex linkages between CSFs and their influence on each other to achieve implementation success. As can be seen from the 'literature review' in chapter 3, the existing literature reports on 'what CSFs are necessary for implementation success', rather than on the complex linkages between these CSFs. The current study adds to the existing knowledge by providing in-depth understanding on the influence of interaction of these CSFs on implementation success.

The findings further suggest that the framework initially developed (figure 3.2) is not suitable to understand ERP implementation success in Indian medium sized firms. The case studies indicate that each firm had its own implementation steps and they do not all follow similar steps as identified in figure 3.2. Furthermore, this framework illustrates CSFs corresponding to implementation phases. However, the CSFs are important throughout ERP implementation, rather than in any one particular phase. For example, findings in this study clearly show top management involvement, effective communication and vendor's support are required consistently throughout ERP implementation for implementation success.

8.3.4 Research question 3 - How does the absorptive capacity of the firm influence the successful implementation of ERP?

8.3.4.1 Introduction

The discussion in chapter 7 (section 7.6) shows group A firms 1, 2, 3 and 4 with implementation success on schedule had higher absorptive capacity compared to group B firms 5 and 6 with implementation delay (medium absorptive capacity) and group C firms 7, 8 and 9 (lower absorptive capacity) with unsuccessful implementation. The discussion of absorptive capacity components is presented below.

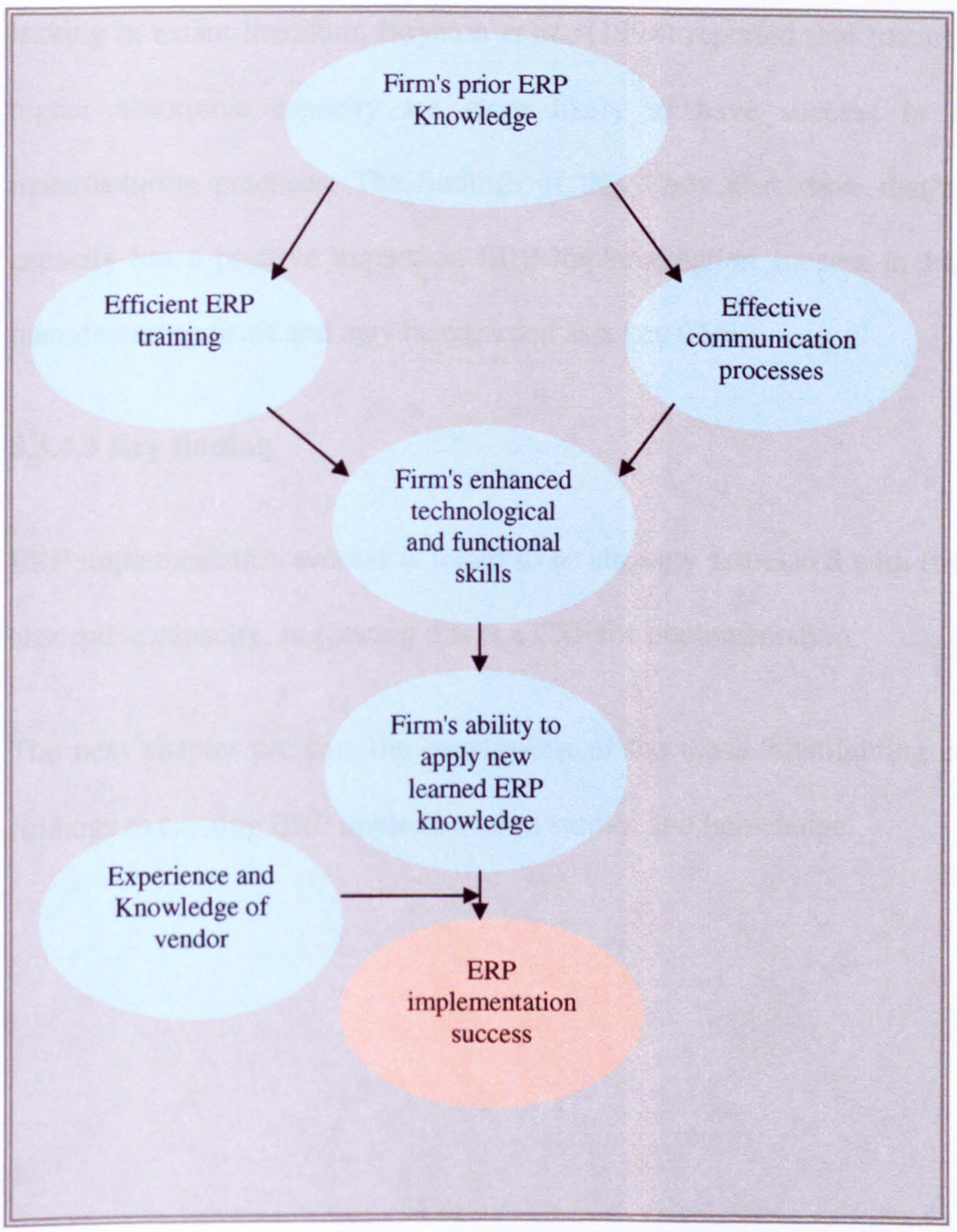
8.3.4.2 Discussion

Table 7.8 (chapter 7) and the discussion in sub-section 8.3.2.1 clearly demonstrates that group A firms' top management, ERP implementation team members and vendors had higher prior ERP knowledge and experience compared to groups B and C. In this group, firms had higher technological skills, good business understanding and knowledge of effective project planning. These findings are consistent with the work of Zahra and George (2002) that suggests absorptive capacity as an important factor for an organisation to implement new IS successfully.

According to Cohen and Levinthal (1990), effective communication connects the organisation and is essential for enhancing absorptive capacity and integrating functional units.

In group A, regular contact and interactions both within the firm and with other firms led to the sharing of ERP knowledge and experience which helped in further improving the existing absorptive capacity (figure 8.7). This also resulted in minimising the resistance of end-users and personnel to the adoption of ERP. Levinson and Asahi (1995) have also reported in their study that the introduction of innovative technology includes substantial change and the absorptive capacity of the firm is a critical factor influencing if planned change can be implemented successfully.

Figure 8.7 - Absorptive capacity and implementation success



Source - Compiled by the author

The findings of this study further shows that groups A and B firms had also enhanced their existing absorptive capacity through efficient training processes during the ERP implementation process because, due to their prior ERP knowledge they absorbed new ERP knowledge more effectively (Kostova, 1999; Szulanski, 1996). Training can also be related to the ability to apply external knowledge, by drawing on the prior ERP knowledge.

In group C firms, well organised training and effective communication processes were lacking, and thus did not add to the already existing lower absorptive capacity of these firms.

Although studies on the impact of absorptive capacity on ERP implementation success are lacking in extant literature, Boynton *et al.*, (1994) reported that manufacturing firms with higher absorptive capacity are more likely to have success in implementing new manufacturing practices. The findings of this study also show that a higher absorptive capacity has a positive impact on ERP implementation success in Indian medium sized manufacturing firms and may be regarded as a key CSF.

8.3.4.3 Key finding

ERP implementation success is found to be strongly associated with firms' well-developed absorptive capacity, suggesting this is a CSF for implementation.

The next chapter presents the conclusions of the thesis highlighting contributions of the findings to existing ERP implementation studies and knowledge.

CHAPTER 9: RESEARCH CONCLUSIONS

9.1 Introduction

This chapter presents the research summary and key empirical findings in section 9.2. The contributions of this research both to existing knowledge and to practicing managers are discussed in section 9.3. The major limitations of the research are outlined in section 9.4. Section 9.5 suggests directions for possible future research.

9.2 Research summary and principle findings

The literature review revealed a gap in explaining issues concerned with ERP implementation in SMEs in developing countries. In particular, a lack of research on such implementations in the specific context of Indian medium sized firms that are constrained in terms of knowledge and resources was noted. Therefore, the current study focused on the detailed understanding of the success factors from the firm's ERP stakeholders' perspectives that are likely to influence ERP implementation success in Indian medium sized firms.

A conceptual framework was developed based upon extant ERP literature. This framework was used to guide the research process. DOI theory, the concept of absorptive capacity and RBV of the firm were drawn upon to provide additional insight and understanding of the empirical studies undertaken.

The purpose of using multiple case studies in the present study, as discussed in chapter 5 (research methodology) was to expand and generalise theory (analytical generalisation). Yin (2003) suggests that if two or more cases studies are shown to support the same theory, replication may be claimed. The findings of the present study are based on the comparison between firms which were successful in their implementation with those which were less successful or completely unsuccessful. Replication is achieved in this research as

the findings were consistent across the multiple cases studied. This also makes the present research findings more robust (Iorio, 2004).

As discussed in the preceding chapter, the following are the principle findings of the current study:

1. Selection of suitable ERP implementation strategy and the choice of vendor (market leading or local vendors) are important. The empirical evidence from the findings shows that a big bang implementation strategy through a market leading ERP vendors contributes to successful ERP implementation. However, the choice of vendor and the implementation strategy depends on top management perspective of ERP systems and the availability of resources.
2. The analysis shows that firms who had successful ERP implementation had top management involvement throughout the implementation. The presence of CSFs such as, effective communication, detailed project planning, suitable vendor selection, balance between BPR and customisation, a cross-functional ERP team and an efficient ERP training process was seen only in firms who succeeded in ERP implementation. Those firms that were unsuccessful in implementation either did not demonstrate these CSFs at all, or only in limited way.
3. The empirical evidence from this study shows that higher absorptive capacity of the firm is important for ERP implementation success and should therefore be considered as an important CSF and included in future studies of the role of CSFs in ERP implementation.

9.3 Contributions of the research

9.3.1 Introduction

The results of this study have implications for academic researchers as well as for firms who wish to implement ERP. In the following sub-sections, the contributions of this study are highlighted. Sub-section 9.3.2 introduces contribution to the subject body of knowledge. Sub-section 9.3.3 present implications for SMEs.

9.3.2 Contribution to the subject body of knowledge

The following paragraphs describe the contributions of this study to ERP implementation literature and existing knowledge.

The first contribution made by this study is an empirical contribution to the understanding of CSFs on ERP implementation. Many previous studies (such as Nah *et al.*, 2003) are based on the views of a limited range of staff within an organization, particularly those that are based on quantitative surveys which are completed by single respondents. This study presents the views of a range of staff of CSFs in ERP implementation. These include top management, IT specialists and users, and hence combine a range of perspectives and hence result in a rich understanding of the complex subject of implementation CSFs. For example, as reported in sub-section 8.3.3, this study has added to the existing knowledge of top management as a CSF. One of the most widely cited variables critical to the successful implementation of ERP systems is top management support in studies by Somers and Nelson (2001); Nah *et al.*, (2003); Al-Mudimigh *et al.*, (2001); Shanks *et al.*, (2000); Loh and Koh (2004); Lee and Molla (2006) and Mabert *et al.*, (2003). However, these studies do not provide detailed empirical evidence of how top management commitment throughout implementation influences implementation success. This research has added to existing knowledge firstly, by explaining and providing a detailed understanding of how

top management can involve themselves in various ERP project activities and secondly, through comparison between firms with implementation success and failure, developing an understanding of how top management involvement and their ERP knowledge influences ERP implementation success.

The study also contributes to the understanding of CSFs by empirically demonstrating that they are interrelated. As discussed in chapter 3, previous studies by Bancroft *et al.,* (1998); Mudimigh *et al.,* (2001); Umble *et al.,* (2003); Motwani *et al.*, (2005); Mandal and Gunasekaran (2003) consider CSFs as discrete and independent and suggest simple lists of CSFs to make ERP successful. This study demonstrates that mere presence of independent CSFs are not enough to make ERP implementation successful and that CSFs are inter-related in a complex way (figure 8.6, chapter 8). In particular, the inter-relationships between CSFs identified in this study show the central role of continuous top management involvement throughout the implementation process in achieving implementation success. This finding is consistent with the finding of the importance of prior knowledge and experience of top management as part of the absorptive capacity of the firm and the influence of this on implementation success.

A further contribution is the empirical operationalisation and investigation of the components of absorptive capacity in the context of ERP adoption. As discussed previously in chapter 4 (section 4.4), there are very few empirical studies that explore the impact of absorptive capacity on IT implementation success. Specifically, there is an absence of research that investigates the influence of the firm's absorptive capacity on ERP implementation success in an Indian context. Thus, a framework (figure 4.5, chapter 4) was developed, informed by earlier studies (Cohen and Levinthal, 1990; Mowery and Oxley, 1995; Zahra and George, 2002), to understand the level of absorptive capacity in the nine case studies and its impact on ERP implementation success. Further, this research provides empirical evidence that a firm's higher absorptive capacity acts as the enabling

environment which makes it possible for a firm to implement ERP successfully. The empirical results suggest how firms who had succeeded in implementation used accumulated ERP knowledge to assimilate external knowledge (for example, through training from external ERP experts or consultants or effective interaction by sharing knowledge with other firms who have succeeded in ERP implementation) to increase the absorptive capacity of a firm. Increased absorptive capacity led to the effective utilisation of available resources in undertaking ERP project activities thus contributing to ERP implementation success. These findings extend the work of Cohen and Levinthal (1990) and Zahra and George (2002) that conceptually link increased absorptive capacity to increased innovative performance in organisations. In particular, Cohen and Levinthal (1990) link absorptive capacity to the adoption of innovations, however they provide no empirical data. Levinson and Asahi (1995) also reported in their study that the introduction of innovative technology includes substantial change and the absorptive capacity of the firm is a critical factor that influences whether planned change can be implemented successfully, but do not address the particular context of IT system adoption.

Combining the empirical contributions described above, leads to the final contribution of the research which is the theoretical explanation of 'why only some medium sized firms succeed in ERP implementation, while others experience implementation failure'. This is the first study, to the researcher's knowledge, that demonstrates how in addition to the main CSFs identified in the literature, the internal resources and existing ERP knowledge base of firms are crucial factors in the successful implementation of ERP systems. The study therefore extends the current understanding of CSFs and their role in the success of ERP implementation.

9.3.3 Implications for SMEs

The important lessons learned from the nine case studies presented in this study, can assist other firms in the future and their implementation teams to understand the ERP implementation process and factors that influence implementation success. The following recommendations can be derived from the research findings:

1. None of the earlier studies have highlighted the complexity of CSFs involved in ERP implementation success. The results of this study provide clearer understanding on CSFs, their linkages, their importance and detailed explanation why these are necessary to be considered during the ERP implementation process. The thesis confirmed the findings in the available literature that support from top management is important. However, this research further contributes by providing empirical evidence that shows how top management involvement impacts other ERP project activities (such as vendor selection process) and results in ERP implementation success in Indian context. The thesis has also shown that verbal commitment is not sufficient. To be effective, top management support has to involve direct participation on the part of top management in the process of ERP implementation. The strong linkages of top management commitment with other CSFs suggests (chapter 8, figure, 8.6) top management involvement plays a crucial role in the ERP implementation success. This research provides empirical evidence that shows how top management involvement impacts on other ERP project activities (such as the vendor selection process and the overcoming of initial user resistance) and results in ERP implementation success.

2. The findings of this research suggest that firms need to recognise the significance of internal resources and organisational knowledge of ERP implementation to achieve ERP implementation success in their firms. The development of ERP knowledge base can be initiated before ERP implementation, if organisational knowledge on the concept, importance and implementation process is low. In cases where firms have

prior ERP implementation experience or personnel possess prior ERP knowledge, then firms can develop further relevant knowledge of ERP team members during the implementation. Thus the findings vindicate the value of appropriate staff development and training.

9.4 Limitations of research and directions for future research

The previous section highlighted the contributions and implications of this study. Although the findings provide valuable insights on how firms can succeed in ERP implementation, limitations of this study need to be acknowledged. This section also suggests areas for future research.

Consistent with other case study based research, and as discussed in chapter 5, this study sought to achieve analytical generalisation (Yin, 2003), rather than statistical generalization. Hence it has intended to increase understanding of the mechanisms of how CSFs operate and inter-relate, and how absorptive capacity contributes to implementation success in the particular case of ERP implementation in medium sized Indian firms rather than reflect the experience of the entire population of firms. In order to achieve statistical generalisation, large scale quantitative studies, such as a survey based study could be undertaken. The design of questionnaires for such studies could be based on the research framework developed in this study, shown in figure 4.4 (chapter 4) and informed by the findings of this study. In particular a quantitative study could be based on figures 8.6 and 8.7 in chapter 8 that shows the inter-relationship between CSFs and the components of absorptive capacity and their linkages on successful implementation respectively. Such quantitative studies would be able to substantiate these linkages in a wider population and through techniques such as regression analysis would be able to quantify the influences of the individual components on implementation success.

Whilst generalizations from case based research should always be done cautiously, it is expected that the findings from this study could be extended to other similar contexts. For example, whilst the study was undertaken in the particular context of Indian firms, it is likely that similar conditions such as limited prior IT knowledge amongst staff and limited experience of vendors would exist in other developing countries. Hence the findings are also likely to apply to ERP adoption by medium firms in similar countries. Similarly, whilst the study focused on ERP, it is likely that the findings will be similar for the adoption of other enterprise-wide IT systems that are being implemented by many firms, such as customer relationship management (CRM) and supply chain management (SCM) systems. Finally, whilst the focus of the study was on medium sized firms, many small firms are likely to face similar constraints and challenges to medium sized firms, hence the findings are also likely to apply to small firms. Further case studies should be undertaken in some of these other contexts to confirm if the findings do indeed transfer to these other contexts, or if not, to understand how and why there are differences.

The findings of this study are based on nine case studies of manufacturing industry. Other industries, for example, service based firms implementing ERP systems may face different or additional challenges, such as the need to involve the customer in the service delivery process. Though this study provides some possible suggestions of the role of industry sector on ERP implementation, further studies need to be carried out to examine if the findings of this study can be directly extrapolated to firms in different industries.

This research focuses on implementation, that is, after the initial decision to implement ERP has been made. Therefore, the present study has only briefly explored the reasons for ERP adoption and influence of internal and external pressures in ERP adoption in the nine cases (see sub-section 6.10.2 for a discussion of the influence on adoption). However, further research can be conducted to broaden the initial findings from this research and to study the influence of pressures on implementation success.

Further research could also be undertaken on the earlier stages in the process to explore if and how the steps involved in the initial decision to implement ERP influences success. Whilst DOI theory was considered in this study, it was not used extensively as the focus was on implementation. A study focusing on the decision to adopt would draw more heavily on DOI. This would provide the possibility of linking DOI to the theories that have been shown to be related in this study, that is, absorptive capacity and RBV. Similarly, future research could focus on the later stages of post-implementation to explore the actual use of ERP in changing the firm's business model and the effects of this on business performance.

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Appendix 1: Questionnaire

1. What is the name of your company?
2. What is the year of establishment of the company?
3. How many employees work in the company?
4. Please provide name of locations of the company.
5. Where is the head office located?
6. What is the organizational structure of the company?
7. What is the annual turnover of the company?
8. Which industry does the company belong to?
9. Please provide the year of ERP implementation.
10. Could you please tell name of locations where ERP is implemented.
11. How much time did it take to complete the ERP implementation?
12. What is the estimated ERP cost?
13. What was the number of employees involved in implementation?
14. Please list the ERP modules implemented.
15. What was the implementation strategy (big bang, step-by-step and roll out)?
16. Who was the ERP vendor?
17. Who was the project champion?
18. Who were the project team members?
19. What is the number of end users?
20. What is the expected/realized annual savings after ERP implementation?
21. Please specify the on-time delivery performance improvement after ERP implementation?

Appendix 2: Interview schedule for top management

A. Company Details

1. Company name
2. Company's business
3. Your name
4. Your job title
5. Annual turnover for the company
6. Company establishment year
7. Number of personnel in the company
8. Size of company: small or medium

B. Details of previous enterprise technology/legacy system

1. Was the system developed/designed in house or outsourced

If in house	If outsourced
• who played major role in developing it • reasons for in-house • Modules implemented • Development cost approximately • Implementation cost approximately • Benefits gained • limitations	• who played major role in developing it • reasons for outsource • Modules implemented • Development cost approximately • Implementation cost approximately • Benefits gained • limitations

C. Migration from legacy system to current ERP

1. Fresh ERP installation or upgrade of previous legacy system
2. Strategy to move from previous to new one
3. Whose idea

4. Reasons for migration
5. How need analysis made
6. Who did need analysis

D. Current ERP technology

Initiation Phase

1. Who initiated
2. Who supported the most
3. Why did the company decide on an ERP solution
4. How the assessment for infrastructure, availability of resources carried out
5. Who conducted assessment
6. How ERP investments calculated
7. Did you calculate return on investments
8. How implementation time calculated
9. What kind of feedback received from managers and users

Preparation Phase

Business requirement analysis

1. How the decision on implementing particular modules was taken
2. Were business needs for the future kept in mind
3. Whose support is required at this stage
4. Who was actively involved in this process
5. What was your role in this

Vendor selection

1. Describe the process of vendor selection (from many vendors to finally choosing one vendor)
2. What were the main reasons for selecting this particular vendor
3. Whom do you think was the final authority in selecting a vendor
4. Who was actively involved in this process
5. What was your role in this

Strategy

1. What is your company's business strategy
2. Was need for Business process re-engineering looked into

3. Analysis of kind of change management might be required
4. Describe the project plan made at this stage
5. How many team members were chosen
6. What were the criteria for selecting team members
7. Kind of response received from team members
8. Who was actively involved in this process
9. What was your role in these activities
10. How frequently meetings conducted among ERP stakeholders
11. Were kind of challenges that might come up were looked into
12. How additional resources that might be required were looked into

Implementation Phase

1. ERP implementation approach: Big bang, phased or parallel running
2. Was the ERP system implementation align with the business strategy
3. How frequently meetings were held between- vendors-IT consultant-managers-top management-users
4. What was the cost of implementation approximately: cost of s/w, cost of consultants, cost of additional resources
5. Do you think it exceeded the project budget
6. If yes, by what percentage and why
7. Who were in the implementation team
8. kindly describe the responsibilities taken by different team members
9. Is your company satisfied with ERP? If no, why
10. On what basis it can be defined as success or failure in your opinion
11. How do you think it is a success(or failure) in this company
12. How frequently the project progress was updated to: employees and ERP team members
13. What measures were taken up for the smooth flow of the information
14. Does the project manager had any previous experience in ERP implementation
15. If yes, how many years
16. How the company addressed change management issues
17. Did the company reengineer the business process?
18. If yes, kindly provide details
19. Who was the project champion for the ERP solution
20. What responsibilities were undertaken by project champion

21. Describe the challenges faced by the company (like data accuracy issues, communication problems)
22. How these challenges were addressed
23. Can you describe some incidences related to this
24. Who all were actively involved in this phase(or, level of involvement by: users, managers, IT consultant, top consultant, vendors)
25. How do you think top management can give their support at this phase
26. How would you describe your role and involvement in your company's ERP implementation
27. How would you describe the relationship/co-operation between IT managers and top management
28. Do you think their relationship might have an effect on implementation process
29. What do think are the critical success factors
30. What were the critical success factors in ERP implementation in this company
31. Can you summarize any lessons learned in the whole process or possibly, any related incidences
32. Can you describe in detail the process of implementation(from the stage of making business blue print till it went live)

Post implementation Phase

1. What are the benefits that company has derived after implementation? Please give examples
2. How has ERP helped in individual processes
3. What were the weaknesses in above processes before implementation? Give examples
4. What do you think has remain unresolved in business even after ERP implementation
5. Any issues faced
6. How the company monitor and evaluate the performance of ERP
7. Who all were actively involved in this phase(or, level of involvement by: users, managers, IT consultant, top consultant, vendors)
8. How would you describe your role and involvement in your company's ERP post-implementation phase
9. What are the company's future plan

Appendix 3: Interview schedule for IT managers

A. Company Details

1. Company name
2. Your name
3. Your job title

B. Details of previous enterprise technology/legacy system

2. Was the system developed/designed in house or outsourced

If in house	If outsourced
• who played major role in developing it • reasons for in-house • How many team members • Modules implemented • Development period • Development cost approximately • When implementation started • When implementation finished • Implementation cost approximately • Benefits gained • limitations	• who played major role in developing it • reasons for outsource • How many team members • Modules implemented • Development period • Development cost approximately • When implementation started • When implementation finished • Implementation cost approximately • Benefits gained • limitations

C. Migration from legacy system to current ERP

1. Strategy to move from previous to new one
2. Whose idea
3. Reasons for migration
4. How need analysis made

5. Who did need analysis

D. Current ERP technology

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5. Who conducted assessment
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7. Did you calculate return on investments
8. How implementation time calculated
9. What kind of feedback received from managers and users

Preparation Phase

Business requirement analysis

1. How the decision on implementing particular modules was taken
2. Who was actively involved in this process
3. What was your role in this

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1. Describe the process of vendor selection (from many vendors to finally choosing one vendor)
2. What were the main reasons for selecting this particular vendor
3. Whom do you think was the final authority in selecting a vendor
4. Who was actively involved in this process
5. What was your role in this

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1. What is your company's business strategy
2. Was need for Business process re-engineering looked into
3. Analysis of kind of change management might be required
4. Describe the project plan made at this stage
5. How many team members were chosen
6. What were the criteria for selecting team members

7. Kind of response received from team members
8. Who was actively involved in this process
9. What was your role in these activities
10. How frequently meetings conducted among ERP stakeholders
11. Were kind of challenges that might come up were looked into
12. How additional resources that might be required were looked into

    a. Manpower
    b. Financial
    c. Hardware
    d. Software
    e. Any other infrastructure

13. Training assessment
14. Kind of training provided (duration of training, content of training, fundamental/technical etc)
15. Who all got training
16. Users response on this

Implementation Phase

1. When did u start implementing
2. When did you finish implementing
3. Do you think implementation took place with in time limit as initially planned
4. If no, why
5. ERP implementation approach: Big bang, phased or parallel running
6. Was the ERP system implementation align with the business strategy
7. How frequently meetings were held between- vendors-IT consultant-managers-top management-users
8. What platform/operating system is required to run ERP software
9. What was the cost of implementation approximately: cost of s/w, cost of consultants, cost of additional resources
10. Do you think it exceeded the project budget. If yes, by what percentage and why
11. Who were in the implementation team
12. kindly describe the responsibilities taken by different team members
13. Is your company satisfied with ERP
14. If no, why
15. On what basis it can be defined as success or failure in your opinion
16. How do you think it is a success(or failure) in this company

17. How frequently the project progress was updated to: employees and ERP team members
18. What measures were taken up for the smooth flow of the information
19. How many end users are using it
20. What are their responses to this technology(finding it useful/not useful)
21. How was their reaction initially for using this technology
22. If they resisted initially then how that situation was dealt with
23. Does the project manager had any previous experience in ERP implementation
24. If yes, how many years
25. How the company addressed change management issues
26. Did the company reengineer the business process?
27. If yes, kindly provide details
28. To what extent ERP software was customized
29. How did it make effect on costs, project implementation, business process
30. How the process of testing and troubleshooting carried out before the ERP system went live
31. Who was the project champion for the ERP solution
32. What responsibilities were undertaken by project champion
33. Describe the challenges faced by the company (like data accuracy issues, communication problems)
34. How these challenges were addressed
35. Can you describe some incidences related to this
36. Who all were actively involved in this phase(or, level of involvement by: users, managers, IT consultant, top consultant, vendors)
37. How do you think top management can give their support at this phase
38. How would you describe your role and involvement in your company's ERP implementation
39. How would you describe the relationship/co-operation between IT managers and top management
40. Do you think their relationship might have an effect on implementation process
41. What do think are the critical success factors
42. What were the critical success factors in ERP implementation in this company
43. Can you summarize any lessons learned in the whole process or possibly, any related incidences
44. Can you describe in detail the process of implementation(from the stage of making business blue print till it went live)

45. ERP-customisation: technical(when system is customised to fit the process)-module selection, tables configuration, code customisation or process(when a process is customised to fit the system)-no change, incremental or radical
46. Additional capabilities- Evolution upwards(advanced planning and scheduling, data warehouses, BI systems) and evolution outwards(CRM, SCM, e-commerce)

Post implementation Phase

1. What are the benefits that company has derived after implementation? Please give examples
2. How has ERP helped in individual processes
3. What were the weaknesses in above processes before implementation. Give examples
4. What do you think has remain unresolved in business even after ERP implementation
5. Have users received any training at this stage
6. If yes, kind of training received
7. Feedback received from users
8. Any resistance from employees/users
9. How the issue of resistance solved
10. Any issues faced
11. How the company monitor and evaluate the performance of ERP
12. Who all were actively involved in this phase(or, level of involvement by: users, managers, IT consultant, top consultant, vendors)
13. How do you think top management can give their support at this phase
14. How would you describe your role and involvement in your company's ERP post-implementation phase
15. What are the company's future plan
16. Kind of vendor support received at this stage

Appendix 4: Interview schedule for users

A. Company Details

1. Company name
2. Your name
3. Your job title

B. Migration from legacy system to current ERP

1. Why do you think it was important to migrate from legacy system to current ERP?
2. How do you think ERP has helped in the business processes
3. Did you get any training beforehand

C. Current ERP technology

Initiation Phase

1. To what level you were involved in this phase
2. What kind of roles did you play in this phase

Preparation Phase

1. Who was actively involved in this process and what were their roles
2. What was your role in these activities
3. How frequently meetings conducted among ERP stakeholders
4. Were kind of challenges that might come up were looked into
5. How were the necessary resources identified

    a. Manpower
    b. Financial
    c. Hardware
    d. Software
    e. Any other infrastructure

6. How frequently you were updated about the progress
7. Was your feedback taken from time to time
8. What was your feedback
9. In your view, what are the critical factors that can make ERP successful
10. In your view what are the issues that the company has to be careful about

11. Kind of challenges that came and how were they overcome by the company
12. Training assessment
13. Kind of training provided(duration of training, content of training, fundamental/technical etc)
14. Who all got training
15. How beneficial was it?
16. How willing you were for this training
17. Would you recommend any changes in the training? If yes, what will they be
18. At what level do you think top management has involved you in the planning phase?
19. Do you think if you are involved more, you could have helped in the process in any way? If yes, how

Implementation Phase

1. Do you think implementation took place with in time limit as initially planned
2. If no, why
3. How frequently meetings were held between- vendors-IT consultant-managers-top management-users
4. What platform/operating system is required to run ERP software
5. Who were in the implementation team
6. kindly describe the responsibilities taken by different team members
7. Is your company satisfied with ERP
8. If no, why
9. On what basis it can be defined as success or failure in your opinion
10. How do you think it is a success(or failure) in this company
11. How frequently the project progress was updated to: employees and ERP team members
12. How many end users are using it
13. What is your response to this technology(finding it useful/not useful)
14. How was your reaction initially for using this technology
15. Did you resist in any way? If yes, then how that situation was dealt with
16. Does the project manager had any previous experience in ERP implementation
17. If yes, how many years
18. To what extent ERP software was customized
19. How did it make effect on costs, project implementation, business process
20. How the process of testing and troubleshooting carried out before the ERP system went live

21. Describe the challenges faced by the company (like data accuracy issues, communication problems)
22. How these challenges were addressed
23. Can you describe some incidences related to this
24. Who all were actively involved in this phase(or, level of involvement by: users, managers, IT consultant, top consultant, vendors)
25. How do you think top management can give their support at this phase
26. How would you describe your role and involvement in your company's ERP implementation
27. How would you describe the relationship/co-operation between IT managers and top management
28. Do you think their relationship might have an effect on implementation process
29. What were the critical success factors in ERP implementation in this company
30. Can you summarize any lessons learned in the whole process or possibly, any related incidences
31. Can you describe in detail the process of implementation(from the stage of making business blue print till it went live)

Post implementation Phase

1. What are the benefits that company has derived after implementation? Please give examples
2. How has ERP helped in individual processes:

a. Sales and Distribution
b. Finance
c. Controlling
d. Production planning
e. Human resources

3. What were the weaknesses in above processes before implementation? Give examples
4. What do you think has remain unresolved in business even after ERP implementation
5. Have you received any training at this stage? If yes, kind of training received
6. What is your feedback
7. Any issues faced
8. How the company monitor and evaluate the performance of ERP

9. Who all were actively involved in this phase(or, level of involvement by: users, managers, IT consultant, top consultant, vendors)
10. How do you think top management can give their support at this phase
11. How would you describe your role and involvement in your company's ERP post-implementation phase
12. What are the company's future plan
13. Kind of vendor support received at this stage

Appendix 5: List of abbreviations

BPR	Business Process Re-engineering
CSFs	Critical Success Factors
DOI	Diffusion of Innovation
ERP	Enterprise Resource Planning
IS	Information Systems
IT	Information Technology
RBV	Resource-Based View
SMEs	Small and Medium Enterprises